Environmental Management and Monitoring
Plan of the
Samarkand and Bukhara Water Supply
Project

Tashkent
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1. INTRODUCTION

1.1. General Provisions

In Uzbekistan, located in the arid zone, the water resources availability is the factor limiting the national economy development. Water is, mainly, taken off from two large-scale international watercourses - Amu-Darya and Syr-Darya rivers. The water supplies of these watercourses are stressed. That is why it becomes more and more actual the requirement of their rational utilization and protection.

Proceeding from the provisions of water divide that have been, in principle, remained since the disintegration of the Soviet Union, the share of Uzbekistan is in average about 48-52 km$^3$ annually (fluctuation depends on amount of the watering season from 54 to 64 km$^3$ a year, among which 41% are in the Syr-Darya basin and 59% - in the Amu-Darya basin). In the total quantity of water resources, the surface waters constitute 57.7 km$^3$ (including the collector and drainage run-offs of 0.8 km$^3$) and the ground waters - 2.9 km$^3$.

The water supplies are used in the following way:

<table>
<thead>
<tr>
<th>Total:</th>
<th>60.6 km$^3$</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>including,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>irrigation farming</td>
<td>54.8 km$^3$</td>
<td>90.4%</td>
</tr>
<tr>
<td>non-irrigation consumers</td>
<td>5.8 km$^3$</td>
<td>9.6%</td>
</tr>
<tr>
<td>Among them:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial and drinking water-supply</td>
<td>2.4 km$^3$</td>
<td>4.1%</td>
</tr>
<tr>
<td>agricultural</td>
<td>1.0 km$^3$</td>
<td>1.6%</td>
</tr>
<tr>
<td>industry</td>
<td>1.3 km$^3$</td>
<td>2.2%</td>
</tr>
<tr>
<td>fishing industry</td>
<td>1.1 km$^3$</td>
<td>1.7%</td>
</tr>
</tbody>
</table>

For the underground waters (the main sources of the drinking water supply) it is typical the non-even distribution of them all over the territory of the country. This caused the construction of the water pipelines of a considerable length. It is necessary to outline that the existing reserves of the ground drinking waters, though they meet at a whole the requirements of the population in drinking water, there has emerged the tendency of deterioration of their quality lately. This will bring finally to decrease in volumes of the waters reserves suitable for drinking. For the eastern part of the republic (where the Bukhara city is located) it is typical the higher mineralization and hardness of the underground waters.

Lack of the water-meters, deterioration of water-supply network, imperfection of management and inefficiency of the tariff system have brought to the losses of significant quantity of drinking water and usage not for the purpose.

The specific water consumption per capita in rural districts is 170 liters a day, in urban districts - 520 liters a day that exceeds the physiological needs.

One of the most important problems is the insufficient delivery to the population, especially in the rural areas, of clean drinking water. In a whole, over one-third of population of the republic has the drinking water that doesn’t comply with the
state standards. More particularly, the problem with drinking water supply exists in Bukhara, Navoi provinces and in the Republic of Karakalpakstan. If, in the Republic in a whole (as of 01.01.1999), out of the 118,000 localities drinking water, 7,300 have drinking water systems or 62%, while in Bukhara province - 24%; Navoi province - 32%; the Republic of Karakalpakstan - 32%.

To improve the ecological situation suitable for the public health, to promote the effective and stable use of the natural resources and protection of the weakest and most important ecological systems and biological species in Uzbekistan with the support and technical assistance of the World Bank, in 1998 the National Environment Action Plan (NEAP) was prepared. Among the priorities identified by the NEAP in respect of improvement of the living conditions of the population there are listed:

- Provision of the rural areas with clean drinking water that is associated with development of the water supply network and improvement of the existing systems;
- Improvement of functioning of the existing water supply network and the water distribution systems in the cities;
- Replenishment and development of the sewerage systems and improvement of the quality of work of the city drainage system, etc.

Pursuant to the NEAP, by the government of the Republic of Uzbekistan it has been adopted the Environmental Action Program of the Republic of Uzbekistan for 1999-2005 (Resolution of the Cabinet of Ministers dated November 20, 1999 №469)

The major objective of the Program is the shaping of the Environmental Strategy of the initial stage of transition of the country towards the road of the stable development identifying the priority ecological problems, selection of the means for their settlement and implementation of the proper organizational arrangements. There are specified the concrete measures, responsible executives, period of implementation, estimated cost and sources of funding. The Program, presently, is under the implementation and the Samarkand and Bukhara cities Water Supply Project should be considered as one of the means of its realization.

1.2. Objective of the Project

The major objective of the Project is the Samarkand and Bukhara cities water supply network improvement of its safety, quality, reliability, efficiency and stability. This objective shall be achieved by:

- The strategic rehabilitation and increase in efficiency of the existing water supply systems being in crucial condition
- The institutional capacity strengthening of the Samarkand and Bukhara cities water supply - vodokanals (SVK and BVK) by conclusion of the service contract with the private operator possessing an international experience in the water supply system operation
• Enhancing of the financial potential of SVK and BVK by improvement of the financial management and work of the sales department.

1.3. The main provisions of the Project

*Enhancing of the financial potential of SVK and BVK by improvement of the financial management and work of the sales department.*

_The existing situation._ The sector of water supply and the sewerage system of Uzbekistan, in particular, of the cities of Samarkand and Bukhara cities, there are typical the following deficiencies in:

- **Low efficiency of exploitation of the system;**
  Due to the out-of-date and damaged equipment, low level of exploitation and technical maintenance, the parameters of the systems’ output and their efficiency have declined. At the same time, the power costs are extremely high; in Samarkand they make up 66% of working costs; in Bukhara - 42%. The water supply systems are suffering from high level of leakage: in Samarkand - 48%; in Bukhara - 39%. As a result of the large-size leakage and non-purposed and non-effective water utilization in Samarkand, it is necessary to produce water approximately in amount of 700 l/d per capita, in Bukhara - 750 l/d.

- **Low level of maintenance and quality of drinking water**
  In Samarkand the water is delivered to 30% of the network only twice a day during 2 hours and with the insufficient pressure in the remaining part of the system.
  For Bukhara it is typical to have a bad quality of drinking water with high concentration of the suspended solids.

- **Emergency state of facilities**
  In both cities the significant part of sewerage system of the secondary sewer system is hydraulically overloaded. The situation with the material and technical facilities of water supplying and sewer systems has lately worsened. It is noticeable the dramatic trend of the worsening in efficiency of the system’s functioning that will inevitably bring to stoppage of the separate sections of the systems and then of the whole system.

- **Financial resources deficit.**
  With reduction of the state subsidies, low water tariffs (in 1999 in Samarkand the tariffs for water utilization per a family made up $0,014 per a m³, in Bukhara - $0,005) in line with the complicated system of mutual settlements and low gathering of fees and payments (in Samarkand -56%, in Bukhara - 79%), it has brought to a great debt indebtedness approximately equal to a 7-month one. The water utilities are functioning at the expense of reduction of technical maintenance and servicing costs, indebtedness on payments for works as well as credit indebtedness to the suppliers, especially to the electric power enterprises.
• Lack of information, weak institutional base and insufficiently high level of the staff’s qualification.
Insufficiently developed system of accounting, management, gathering of financial and business information have made it impossible for the vodokanals to have a clear opinion on the existing problems. Despite the fact that in the water sector of Uzbekistan there are working many high qualified employees, at the same time there exists an urgent necessity to improve qualification of the staff in the sphere of municipal system management, shaping of the strategy on financial and commercial management planning.

• Deficit in water resources
The problems caused by the deficit in water resources are getting more complicated due to an irrational management of the regional water supplying systems and distribution of the water resources, their contamination in some places, the excessive consumption of drinking water resulted from the leakage and lack of the water safety practice. Besides that, the operational expenses of some water utilities, for example, of BVK are extremely high that is caused by the remoteness of the sources of water from the zones of the water supply utilities maintenance and the water has to be delivered through the canals or a large water-main for a distance of hundreds of kilometers.

• The impact of the existing conditions of the water supplying systems on the ecological situation in Samarkand and Bukhara cities.
The unsatisfactory technical situation with the water supplying network (leakage) has brought an increase in taking off the fresh water at the same time aggravating the deficit in water resources of the region.

Taking into consideration the limited volume of the funding resources that may be provided under this Project and taking into account the undeveloped institutional base of SVK and BVK, within the framework of the present Project it is proposed to elaborate only the most simple procedures of its implementation, attaching all attention to improvement of the most urgent sections of the water canals operating (technical and financial), for the purpose of creation of the base for the future continual extension of the support in operational works of SVK and BVK provided by the World Bank and other international financial institutions and bilateral donors. The strategic option in favor of improvement of the water supplying system is explained by the higher efficiency of such approach in relation with improvement of the public health as well as the fact that the inhabitants of Samarkand and Bukhara cities, namely, have demonstrated their preference to this Project’s putting into life.

The components of the Project
The Project consists of three components. The estimated costs of the Project is $ 55.4 million, including $41.7 million that are the facilities of the Bank’s loan.
- **Component 1. The investment fund**
  The estimated cost is $47.6 million, including those for SVK - $26 million and for BVK - $21.6 million. Under this component the main short-term costs shall be financed (purchase of materials, equipment, transportation) and costs for implementation of the minimum capital investments program provided for development of the working systems of water supply utilities and improvement of quality of the population servicing with implementation of the control tasks determined in the service contract.
  Operator jointly with the staff of SVK and BVK shall work out the plan on investments required for optimization and rehabilitation of the key components of the system, implementation of the program on water consumption, creation of the systems of financial management, accounting and management of distribution.

- **Component 2 - Service contract**
  The estimation cost for this component is $3.6 million. Under this component the costs related to the service contract shall be financed and expected to include a base honorarium and, that is principal, a target performance-based fee, a bonus payment to the private Operator. The Operator shall have full rights to manage the implementation of the Investment Program, running the water supply system, development and implementation of the program on the water consumption control as well as management of the financial and distribution departments.

- **Component 3 - Consulting services and the Project Coordination Center (PCC)**
  The estimated cost of this component is $1.8 million. Under this component there shall be financed the work of the Project Coordination Center, of the independent technical and financial auditors who shall keep the control over the implementation by the Operator of the targeted tasks, the work of the independent financial auditors on verification of the Project's accounts and other consulting services.

  The major objective of the Project shall be a gradual rise of profitability of SVK and BVK. The settlement of this problem is expected to be implemented at the expanse of cutting down of the costs caused by the low efficiency of the system's functioning, raising the tariffs and collection of fees and payments, cutting down of the debt indebtedness of the state entities (organizations) and enterprises to SVK and BVK, reduction of payments on mutual settlements, improvement of accounting, gathering the required information and planning.

1.4. **Researched territory.**

Taking into account, that quality of drinking water of Samarkand and Bukhara cities depends in many of the state of superficial and underground waters of a modern valley Zaravshan river, considered not only objects directly covered by Project - station of water-treatment, distributive network of Samarkand and Bukhara cities, but also territory of formation of a deposit of fresh underground waters (sources of drinking water supply) in a modern valley of the river Zaravshan and the whole state of the river. The detailed information about environmental
Deterioration of ecological and sanitary-and-epidemiological states in Zaravshan river basin in conditions of low water-level has motivated in 2001 the creation of a special commission to inspect all potential sources of pollution of Zaravshan river (including dumps of collector-drainage waters), underground waters, quality of water in the river and drinking water in-taking in Samarkand, Navoi and Bukhara regions.

Results of analyses of water’s tests of Zaravshan River according to the inspection, which have been carried out by UzGlavgidromet, are given in Table 1 and drawings 1,2.

Apparent from the Table the level and character of pollution is various, both on points, and on intensity, however the greatest danger is represented with pollution of water by mercury.

Quality of drinking water on water in-takings of Samarkand and Bukhara cities is applied in the table 2. Values are inside range of treatment of stations.

2. Assessment procedure

The common ecological assessment procedure includes the definite stages of environmental assessment. The most important of them are:

- Main problems identification
- Determination of these problems’ scale
- Mitigation measures
- Management and monitoring

The experts have fulfilled the gathering and inventory of the data base on the environmental conditions in the Zaravshan basin.

There were considered the following ecological aspects:

- Water resources
- Land resources
- Ecological resources
- Social aspects

Below, there is given a general ecological assessment of the anthropogenic impact at implementation of the Samarkand and Bukhara cities Water Supply Project and it has been worked out the Action Plan of Nature Protection Measures

3. Organizational, legal and politic structure for the Project implementation

The present Section is a brief summary of organizational, legal and politic structures
3.1. General national structure

3.1.1. Organizational Structure
Pursuant to the existing administrative and territorial division of the Republic of Uzbekistan the cities of Samarkand and Bukhara are the provincial centers of the Samarkand and Bukhara provinces, respectively.

For the purposes of this ecological assessment there are considered 4 concerned government bodies (authorities):

- Ministry of Municipal Utilities restructured into ‘Uzkomunhizmat’ agency - an organizer of the Project
- Hokimiyats of the provinces and cities where this Project is located
- Bukhara Vodocanal and Samarkand Vodocanal - the executors of the Project
- State Committee for Nature Protection (Goskompriroda) - a body responsible for environmental protection.

The other appropriate government bodies including the National Sustainable Development Committee.

*Ministry of Municipal Utilities (MMU)* was responsible for working out the policy, coordination, standards, elaboration of the manual and technical development of the municipal water sector. At present time, all these functions have been placed upon the ‘Uzkomunhizmat’ agency.

*Hokimiyat* is an executive body of the government power at the level of province, region, city. Hokim is an executive person and at the same time he heads the representative and executive power on the corresponding territory and provide the implementation of the general tasks on the social and economic development, observance of the laws and other legislative acts. Hokim of the province is appointed and dismissed by the President of the Republic of Uzbekistan and approved by the People’s Deputies Council.

*State Committee for Nature Protection (Goskompriroda)* is a leading organization for the environmental protection which is responsible for ecological monitoring, control and development of the national ecological strategy. Goskompriroda is also responsible for the State Ecological Expertise (SEE) and observance of laws on ecology. Goskompriroda has its own subdivisions in all provinces.

*The National Sustainable Development Committee* is a coordinating organization at the national level, which insures the sustainable development, adequate weight at the stage of scheduling the measures in various sectors, including municipal utilities. It has designed a draft of the National Strategy and the Action Plan on sustainable development. The Committee plays an advisory role in the process of planning at the national level. At the international level the Committee
coordinates the actions with the partners from the other countries in arrangements possessing the trans-bordering impact.

3.1.2. Legal and economic structures

Legal structure
The legislative framework is determined by the Constitution of the Republic of Uzbekistan. (1992)

Economic Structure
Uzbekistan has adopted the program on gradual and monitoring transition from the planned economy towards the market-oriented one. The priority areas of development are the branches of industry reprocessing the local raw materials and resources as well as the branches aimed at the import substituting and export potential development.

The private sector is a comparatively new concept in Uzbekistan. Privatization in the municipal utilities is a very complicated problem and requires the consultative and financial support. With respect to the technical and ecological consultative services, it may be said that there haven't been established such private firms in the country yet.

Economic framework of the activity of the state power in places (on sites) constitutes the state-owned property of the administrative and territorial entities (municipal ownership) and other property existing in province, region, city and serving the economic and social development.

The order of management of the property passed to the economic possession of the province, region, city shall be governed by the legislation of the Republic of Uzbekistan. As to the objects of the state-owned property being the exclusive ownership of the Republic of Uzbekistan, Hokim shall exercise the control over the reliable allocation of the industrial and social objects, rational consumption of the natural and labour resources, environmental protection, social defense of population.

Khokim is not obliged with the rights to enact the limitations not stipulated by the legislation of the Republic of Uzbekistan for enterprises of any form of property located on the territory within his jurisdiction (being under his control) which may become an obstacle in a free entrepreneurship.

3.2. Ecological structure

In accordance with the Constitution of the Republic of Uzbekistan the land, depths of the earth, waters, fauna and flora and other natural resources shall constitute the national wealth and shall be rationally used and protected by the State.

In Uzbekistan there is the following system of the environmental protection management:
Oliy Majlis (the Parliament) of the Republic determines the main trends in the environmental protection policy, approves the legislative acts and coordinates the activity of the State Committee for Nature Protection (Goscompriroda). It declares the zones of extreme ecological situation, ecological disaster and ecological catastrophe, define the legislative regime in these zones and the status of victims.

The President of the Republic of Uzbekistan approves the strategic decisions on ecological problems, implements the international cooperation, management in the sphere of the environmental protection.

The Cabinet of Ministers implements the State environmental protection policy, adopts the State ecological programs, controls their implementation, arranges accounting and assessment of the natural resources, maps out the measures on prevention of the ecological crises, disasters and catastrophes, etc.

Local authorities of the state power determine the main directions in the Nature Protection Activity in the territory being under their jurisdiction, approve regional (territorial) ecological programs, conduct accounting and assessment of the natural resources condition and unhealthy ecological objects, provide the material and technical arrangements on the nature protection, etc.

The State Committee for Nature Protection is directly subordinated to Oliy Majlis and is a head executive body on the environmental protection in Uzbekistan. The competence of Goscompriroda is governed by the Regulations approved by the Resolution of Oliy Majlis of the Republic of Uzbekistan dated April 26, 1996.

Goscompriroda is a specially authorized over-departmental and coordinating body effecting the state control and inter-branches management in the sphere of nature protection, utilization and replenishment of the natural resources. The Organizational Structure of Goscompriroda is presented in Appendices 3 and 4.

All decisions of Goscompriroda adopted within its competence shall be binding for the state entities, enterprises, institutions, organizations and citizens as well.

Goskompriroda implements:
- analysis of anthropogenic activity impact on the environment;
- ecological expertise of the projects and programs
- stimulation of the low waste technologies
- control over the observance of the ecological norms and standards
- coordination of the programs on ecological measures
- development of ecological monitoring structure
- management of the natural reserves (national parks)
• approval of the environmental quality norms, issuance and cancellation of the permissions for sewerage, runoffs of the polluting substances, placement of waste products, etc.

Jointly with Goskompriroda, the state control over the nature protection there is effected, within the limits of their jurisdiction, by:
• Agency on the industrial works safety supervision, the 'Sanoatcontehnadzor' agency
• State Committee for Land Resources (Goscomzem)
• Ministry of Health (Minzdrav)
• Ministry of Foreign Affairs (MID)
• Ministry of Agriculture and Water Resources (Minselvodhoz)
• State Inspection for Control and Supervision over technical state and safety of the works of the top importance and other water supply utilities

The short and long-term projections for the environmental conditions as well as development and creation of the statistic database on the environment-friendly use of the nature is a part of the objectives of the Ministry of Macroeconomics and Statistics (Minmacroeconomstat)

The environmental monitoring is implemented by:

• Main Department on Hydromethereology under the Cabinet of Ministers (in the sphere of surface waters)
• State Committee for Geology (in the sphere underground waters)
• Goscompriroda (in the sphere the sources of pollution)

In the Republic there has been created and constantly improved the legislative environmental protection framework. By present there have been approved about 80 legislative acts and by-laws (Appendix 3) regulating the relations of the users of natural resources and establishing the criteria of the ecological safety of works.

3.3. Water Supply and Sewerage Sector Structure

In accordance with the Civil Law of the Republic of Uzbekistan, the Bukhara province and Samarkand city vodocanals (utilities) are unitary state enterprises. They are also independent economic subjects established under the decision of the state body on the basis of the state-owned property of the administrative and territorial entities (municipal property) based on the right of the operating management.

The constituent documents of the vodocanals are their Charters that are approved by Hokimiyats.
The financial activity of the vodocanals is not stipulated by the legislation of the Republic of Uzbekistan and is implemented in common order.

In accordance with the Law of the Republic of Uzbekistan 'On Natural Monopolies' the vodocanal enterprises providing municipal services of the water supply and wastewater are subjects of natural monopoly.

By the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated December 21, 2000 №493 'On Improvement of the Activity of the Municipal Utilities System' there the System of the Municipal Services Management was reformed (Appendix 5).

There was created the 'Uzcommunhismat' agency which was expected to implement:
- exploitation and development of the inter-regional water supply pipelines (including Damhodjinsk water supply pipeline);
- prognostication of the water industry;
- monitoring of realization of the reforms on municipal servicing and material and technical supply

4. A state of the environment.

4.1. The brief description of a state of the environment.

The river Zaravshan is a transboundary watercourse and concerns to the most density populated and industrially advanced regions of the Republic of Uzbekistan. The river Zaravshan originates from a glacier located on Turkestani and Zaravshan mountain ranges junction in territory of Tadjikistan. Long-term average drain of the river $5.3 \text{ km}^3$, length of 781 kms.

Inflows of river Zaravshan - Fandarya and Magiyandarya are located in territory of Tadjikistan UzGlavgidromet has no posts of supervision on the given inflows nor the data on quality of water in them is absent.

The river is a unique source of water supply of the population of Samarkand, Navoi and Bukhara areas and passing on territory of these areas becomes polluted with components of an organic and mineral origin.

Monitoring of quality of water of the river Zaravshan is carried out by bodies of UzGlavgidromet on 8 points.

The river Zaravshan is most subject to transboundary influence. In a zone of formation of a drain of the river are located objects of mining of Republic of Tadjikistans, which pollute the river by toxic metals, antimony, mercury. Monitoring behind specific components (antimony, cadmium, strontium etc.) now is not conducted.
In territory of Uzbekistan the river is affected by the sewage from industry enterprises of Samarkand, Kattakurgan, Navoi and sewage from farmlands. By consideration of an ecological state of the river Zaravshan, a degree of its pollution on different regions is estimated on different levels.

The river Zaravshan during last years, on the Index of Impurity of Water (IIW), on sites of the Samarkand and Bukhara areas concerns to moderately polluted waters (IIW changes from 1.0 up to 2.5). On section of Navoi's region, after Navoi city, quality of water in the river passes to category of dirty waters (IIW achieves 5.6). Quality of water in the river lower Navoi city on IIW was improved in 1997, has passed in III class of moderately polluted waters and it is kept till 2000.

Last 5 years the tendency to stabilization of quality of water in the river was planned. Concentration of copper are within the limits of 0.2-2.6 maximum concentration limits, zinc within 0.1-1.4 maximum concentration limits, chromium within 0.1-1.1 maximum concentration limits (exception makes point lower Navoi city where its maintenance makes 2-7 maximum concentration limits).

Superficial and underground waters in the bottom current of Zaravshan river are characterized by the increased mineralization (0.6-2.0 g/l), hardness, phenols, organic chemistry, that is connected with reduction of fresh water in Bukhara region on Zaravshan river. After increasing of water used to irrigate the grounds in the Samarkand, Dzhizak and Kashkadarinskai regions and with increasing of dump in the river of collector-drainage waters, the mineralization steadily grows.

The river Zaravshan on territory of Bukhara region has extent of 18.5 kms. from the right-bank side and comes to an end on Kharkhur's hydrounit. The drain of the river makes 150-300 million m^3/ year, water of the Amu-Bukhara channel - 1-1.2 km^3/year comes here and that improves quality of water in the river.

Underground waters, from border with Republic of Tadjikistans up to border with Navoi region, are polluted with connections of nitrogen; the contents of nitrates in underground waters on the average from 9 up to 49 mg/l (at maximum concentration limit 45 mg/l), in chinks of a water-using of Jomboi district center - 39-44 mg/l. Presence of antimony in Chupanata and Murtak water-using (is lower than maximum concentration limit) is marked.

To Navoi region the mineralization (up to 2 g/l) is sharply increased and hardness (up to 25 mg-ekv/l) of underground waters, the contents of nitrates is increased up to 107 mg/l, mineral oil - till 0.21 mg/l. Underground waters of Pachtachin and Narpai regions have lost the importance as a source of drinking water supply.

In Navoi region there are local sites of pollution of underground waters with manganese, strontium, radon, cyanic, fluorine (close to tail store of Mining-metallurgical Enterprise).

Within the territory of Bukhara region underground waters become soiled under influence of agricultural factors (mineral fertilizers, chemical preparations of protection of plants, drains of cattle-breeding and poultry-farming complexes).
With a view of improvement of ecological and sanitary-and-epidemiological conditions in Zaravshan river basin, in June, 2001 the Government of Uzbekistan has prepared the special Decision providing:

- An establishment of a water-security zone of Zaravshan river and moving out from it ecologically dangerous objects;
- Giving of the status of especially protected natural areas to zones of formation of deposits of fresh underground waters of a modern valley of Zaravshan river.
- The organization of a post of automatic control quality of water with hydrochemical laboratory on border of Republic of Uzbekistans with Republic of Tadjikistans.
- Additional technical equipment to hydrochemical monitoring laboratories (UzGlavgidromet, territorial Committee on Nature Protection, sanitary epidemiological station) for the organization of additional definitions of specific components (selenium, strontium, cobalt, antimony, mercury etc.).
- Realization of nature protection actions at the separate enterprises.

Samarkand and Bukhara are large administrative, cultural and historical centers of Republic of Uzbekistan.

The existing population of the Samarkand region (Samarkand city, villages: Chishrau, Chakhrin, Samarkand - selskiy, Jomboi) makes about 600 thousand persons., including Samarkand - about 400 thousand persons, Bukhara - about 300 thousand persons.

Samarkand and Bukhara cities are located in Zaravshan valley:

- Samarkand city - in the center, on the left coast of the river
- Bukhara city - in the lower part of the basin, on the right coast of the river

The territory of Samarkand occupies the area about 9 thousand ga., Bukhara city - 2.6 thousand ga.

Building of cities is mixed: one-storied and multi-storied. The basic industrial enterprises concern to tourism, food and building industry.

In cities there is the system of gas supply working on natural gas.

Extent of a city water supply system to Samarkand makes 630 kms. Volume of water consumption - more than 500 day/person. Wastage, leakage in the water network, irrigation of gardens - the reasons of highly consumption of water.

The centralized system of water supply of the Samarkand region, capacity of 380 thousand m3 / per/day, carries out of using underground waters:

- Chapanata - 235 thousand m3 / per/day
- Dagbit - 132 thousand m3 / per/day
- Bagibaland - 6,0 thousand m3 / per/day
- Single chinks - 8,0 thousand m3 / per/day
Sites of existing water-points are combined by powerful thickness of alluvial pebbles from a pebble various size with sandy-gravel contents (30-40 %) with inclusion of small and average boulders of the cast out rock. The level of subsoil waters is on depth of 0.7-2.0 m below a surface of the ground.

Subsoil waters have a mineralization from 100 up to 520 mg/l, less often up to 800 mg/l. Type of a mineralization of underground waters - CaHCO₃. General hardness changes within the limits of 2.0 to 6.0 mg-equiv/l.

With a view of protecting water sources against pollution, zones of sanitary protection (ZSP) are established for Karadarya and Zaravshan rivers, Taliguljan, Dargom channels by width of 100-300 m. from coast of water points where economic activities are forbidden and for underground water-points are established ZSP 1 and 2 zones. As a whole, water-points are located in favorable, from the sanitary point of view, conditions and have good prospects of their operation and expansion.

For provision of water to the Bukhara, Navoi and the western part of Samarkand regions it was constructed the Damchodjin water-pipe with a deep well into the from Zaravshan deposits of underground waters, with design productivity of 300 thousand m³ / per/day, and actual production of 270 thousand m³ /per/day.

Damchodjin and Karadarya water-point are subject to pollution by sewage after clearing constructions of Jomboi and Samarkand.

Table 2 lists the parameters of chemical structure of water at intake works for Samarkand and Bukhara. Values are within operations of water treatment works. The total length of the city water supply system in Bukhara in 462 kms. Consumption of water in city also, as well as in Samarkand more then 500 l/per/day/person. The same reasons: the outflow, the broken armature, having watered personal plots and green plantings.

Water supply of Bukhara city is based on superficial waters of Kujumazar water basin (Kujumazar water-intake - 145 thousand m³/per/day), Dzhujzar channel (Zaravshan water-intake -50 thousand m³ / per/day) and Shachrud (Besharica water-intake). Since 1994, water from Zaravshan deposits of underground waters of the Samarkand district (Damchodjin water-pipe with large bore -110 thousand 3/per/day) serves Bukhara city. Only quality of Damchodjin's water-intake meets the requirements of State standard to drink water without treatment.

Water from water-in-takings is cleared in sediment bowls and filters. After disinfecting in tanks water is pumped to the water supply system of city. General capacity of water-intakes makes 300 thousand m³/per/day, actual production 260 thousand m³/per/day.

In Samarkand and Bukhara cities is present the centralized system of the wastewater collection (scope of the population of 48 % and 59 %) with clearing drains on constructions of full biological clearing in artificial created conditions on aerotancer, in Samarkand additional cleaning on frame-filling filters is stipulated.
Existing capacity of treatment facilities of Samarkand city is 139 thousand m³ / per/night, Bukhara city - 100 thousand m³ / per/night. Discharge of effluent is carried out as follows:

- Samarkand city - on a waste collector in diameter of 1200 mm, extent of 2.4 kms, in collector of Siab and further in Karadarya river.
- Bukhara city - on a collector in the extent of 2 kms in collector Sakovich.

The population not using sewerage and a collector flowing over the territory of Samarkand and Bukhara cities collecting these drains and polluting subsoil waters provide an impact on natural waters and ecological condition of Zaravshan river. Works on an establishment of a water-security zone of collectors Siabcha, Obirachmat, Chashma, channel Siab etc. have begun.

4.2. Definition of the basic environmental problems.

The National Action Plan of Nature Protection determines the following environmental problems:

- Insufficiency of provision to of the population of clean drink water;
- Lack of fresh water;
- Pollution of superficial and underground waters;
- Accumulation of solid waste;
- Pollution of soil;
- Flooding of settlements and industrial sites;
- Destruction of monuments of culture

All these problems are key for both considered cities.

In connection with deficiency of water resources, it is especial for last dry year, in both cities:

- Conditions have become aggravated with maintenance of the population with drink water, and also irrigation water for personal plots and green plantings.
- Water from water-pipe does not answer to hygienic specifications on chemical and microbiological parameters.
- Economic activities in a zone of formation of a drain continue to worsen quality of underground waters of Zaravshan’s river basin.
- Saturation by harmful substances within the limits of the large enterprises, infringement of water and sewer communications, flooding of them is results in pollution of subsoil waters.
- Inefficient work of wastewater treatment plants at the enterprises and discharge of enough – insufficiently treated sewage in watercourses flowing through cities brings pollution superficial waters.
- Irrational uses of drink water (having watered green plantings, outflow in house networks, absence of cranes etc.) aggravate deficiency of water resources.
- Unsatisfactory technical condition of pump stations results in faults of provision of drink water to the population and pollution of adjoining territory by oils (mineral oil).
5. Project environment impact assessment.

5.1. General provisions.

The basic purpose of environment assessment is to reveal environmental problems, which need to be taken into account at realization of the project.

For environment impact assessment it is necessary studying an existing ecological situation that was showed at the description of an actual condition of water resources.

According to project categories of the World Bank guidelines, the level of detail of the ecological analysis depends on scale and ecological influence of planning works. The categories selected on the basis of expert estimations are given below:

- The Category A: full ecological assessment (EA) is required, if significant negative influences are expected;
- The Category B: even if it is not required full EA, it is necessary to carry out the ecological analysis as the project may have negative ecological influences (less significant, than in category A);
- The Category C: if under the project negative influences are not expected, EA or realization of the ecological analysis is not required;
- The Category D: EA or the ecological analysis is not required for projects without expected negative ecological impacts.

For minimization of probable negative influences this project is referred to the Category B (according to OP/BP/GP 4.01 of World Bank) but taking into account that Samarkand and Bukhara cities are located in the international water-source’s basin (near to the river Zaravshan which originates in mountains of Pamir on territory of the neighboring Tadjikistan and one of sources of drinking water supply takes water from Amudarya river) it is required preparation of the ecological information and development of the Environmental Mitigation and Monitoring Plan. (Table 3)

5.2. Project impact assessment.

Realization of the project will not cause any resettlement of inhabitants, expansion of existing capacities or building of any large constructions. The project provides performance only rehabilitation works on those constructions, which are the property of the Samarkand and Bukhara water-utilities, or on those areas which are allocated for an infrastructure of Khokimiyats.

Potential influence of the project would concern:

Improvements of health of the population: the project will increase reliability of
regular water delivery to the population and promotes improvement of quality of the treated drink water (on physical and microbiological parameters), that will result to reduction of decease by waterborne illnesses.

**Reductions of quantity of water used:** elimination of outflow and losses in a distribution network, installation of water-measuring devices of the water use, household and not household consumers will allow to use water resources rationally and will allow to reduce using of fresh water from sources of water supply and will reduce discharge of sewage in system of the water drain.

**Conditions of subsoil waters:** there will be a reduction of volumes and improvement of quality of subsoil waters, due to liquidation of losses at distribution of drink water to the consumer.

*To probable negative impacts on an environment at realization of the project it is possible to attribute:*

**Pollution of environment by waste products by production of repair - reconstruction works.**
Pollution will be limited on time and will render insignificant influence on ground and subsoil waters. Civil work will be carried out during short time and usually dry weather conditions in Samarkand and Bukhara cities will promote restriction of their influence on water objects. Local measures for protection of subsoil waters will be required.

**Violation of rules of removal of silt during sewage treatment.**
Silt formed during water-treatment at its removal may be a source of pollution of ground and waters (superficial and groundwater). Procedure of gathering and recycling of silt will be defined and controlled under its implementation will be set up.

**Waste disposal of construction with violation of rules**
During realization of repair work at stations of water-treatment, network and pipelines building will generate waste products, which demand strict system of gathering, removal and their minimization.

**Violation of rules of safety at chlorination of water.**
Chlorine as poisonous gas, is always a dangerous source for health of the person. The process of chlorination used at disinfecting of drinking waters will be carried out with the established measures of protection and regulations of its submission. The control of the contents of chlorine in air and residual chlorine in water is provided.

**Flooding of fuel or oils in repair - reconstruction works**
Using of combustive-lubricating materials is planned by limited in volume and terms and that is why its influence on an environment will be insignificant. However, building practice of work demands providing of measures on prevention of soil and water pollution.
**Damage of trees and vegetative cover**
Damage of trees and vegetative cover will be insignificant as works will be carried out on earlier laid pipelines. They may be minimized with the accepted appropriate contractual measures.

**Impacts created by repair - reconstruction works, including a dust, noise, vibration, restriction of access, closing of travel, increase of intensity of movement on separate sites**
Formation of dust at realization of repair - reconstruction works, noise at digging ditches, appearance of vibration in the nearest old buildings, restriction of access to buildings, closing of separate sites of roads and violation of automobile movement on it, these impacts during regenerative works on a water supply system and distributive units will be short-term and touch the adjoining population in various time. Influence also will be moderate for the working personnel and the environment. The appropriate measures of mitigation and the control of technology of realization of repair - reconstruction works will be required.

**Stopping delivery of water at replacement of pipes or their repair**
Replacement of old water supply systems will cause faults in water delivery, and damage of other communications (telephone, electric networks) is possible. The necessary measures at designing reconstruction works and obligatory coordination with the appropriate services and the enterprises will be required.

**Risk of accidents in repair - reconstruction works**
Accidents of workers during repair - reconstruction works is possible, but strict observance of the appropriate safety precautions regulations will allow avoiding them.

**Chance findings of cultural resources.**
Archeological and cultural finds are not expected, because works will be carried out on earlier existing system where excavation was carried out before. On a case of archeological finds, the Plan provides the requirement about the publication of special notices, cessation of work and the order of their adequate protection.

**5.3. Definition and implementation of environmental protection measures.**

For the appropriate implementation of the measures directed to mitigation of possible negative consequences of the project, an Environment Mitigation Action Plan (Table 1) is developed.

The environmental actions plan includes recommendations for protection of nature using, and establishes the order and the control measures to carry out repair - reconstruction works:

**5.3.1. Avoidance of impacts in realization of the program of repair - reconstruction works.**
With a view of maintenance of uninterrupted performance of repair - reconstruction works it is necessary to provide the following clauses in the construction contracts:

- For complex objects and special works it is necessary to develop components of the project to product works.
- To implement in the construction of a new effective materials and designs, technologies of conducting works.
- To provide creation of the safety and healthy conditions facilitating work both excluding failures and accidents, maintenance of safety precautions regulations of a labor safety with a correct choice both the technically substantiated sizes of workplaces and their organization.
- Commissioning of the restored objects, which are not adequate to ecological requirements is forbidden.
- To define a sequence of reconstruction works on pipelines to reduce local inconveniences up to a minimum.
- To define procedure of coordination of a stopping delivery of water, whenever possible, on a short time interval.
- To define methods of construction with implementation of a protection of sites of work and to provide transitive bridges through separate trenches. To provide the maximum appropriate access to places of work and residing.
- To demand, that the contract organization guaranteed safe moving and installation of equipment.
- To demand, that the contract organization reroutes road movement in a working zone. Management of road movement, emergency signals and illumination should be established with local Rules. To provide safe detours and transitions for pedestrians if necessary.

5.3.2. Protection of atmospheric air against pollution by construction dust.

To provide suppression of dust during realization of repair - reconstruction works and transportation, through splashing waters in area of work. All building sites, passes, sidewalks to be cleaned after end of works.

5.3.3. Protection of underground waters against pollution by construction waste.

Ensuring of protection of underground waters from pollution by construction waste is regulated by the appropriate building standards and at implementing of monitoring during conducting repair - reconstruction works will allow minimizing their impact on underground water. Construction sites should be provided with a network for removal of a superficial drain and drainage waters. After end of repair - regenerative works all trenches, ditches, and the drainage network are subject to restoration.

5.3.4. Management of repair - reconstruction waste products.

The collection and dispatch of building waste products and their export will be carried out according to building standards of work. Transportation and disposal
should be carried out in places coordinated with SES.

5.3.5. Management of waste products from water-treatment facilities.

Solid waste products formed at water treatment plants and its preparation to State Standard, demand special measures on their processing and warehousing places allowed by the appropriate supervising bodies. Stores for warehousing waste products should be placed on water-proof soil, outside of sanitary zone of buildings and water-security zones of rivers.

5.3.6. Prevention of outflow of chlorine and minimization of its impact.

For prevention of outflow of chlorine at disinfecting drink water, the system of chlorinating should function under vacuum, chlorine room should be built from materials steady against corrosion destruction by chlorine and points of chlorinating should be established outside of a building. The stock of chlorine should be stored in a separate room. Chlorine room should be equipped with the appropriate means of protection of people at work.

5.3.7. Spills of fuel and oils.

All ground capacities of fuel-lubricating materials will be equipped above a terrestrial surface and integrity of their walls will be under the constant control. The appropriate measures to prevent outflow will be required at filling and transportation points. Spilling fuel-lubricating materials on the ground and in watercourse is forbidden. Gathering and recycling of their waste will be stipulated according to ecological requirements.

5.3.8. Accident prevention during realization of repair - reconstruction works.

The construction contracts should include all necessary safety measures for types of civil construction and especially in residential areas with high intensity of movement of people and transport. Security measures will be taken into account and for working personnel on repair - reconstruction sites. Maintenance of worldwide accepted practice and local safety rules will allow to secure and keep health of people and the working personnel.

5.3.9. Measures on minimization of noise and vibration.

At realization of repair - reconstruction works, noise may be minimized through planning and specific restrictions for especially noisy actions. To such actions it is possible to attribute restriction of noisy actions in residential areas for the period from sunset to sunrise. Realization of the standard control and support of all equipment used at repair - reconstruction works and transportation will allow guaranteeing acceptable noise levels.

It is necessary to provide reduction of excessive vibration from heavy machines during repair - reconstruction works whenever possible. In some cases, probably, implementation of a special management will be required.
5.3.10. Damage of trees and a vegetative cover.

All destroyed vegetation is subject to restoration. Decorative trees damaged during realization of repair - reconstruction works will be replaced.

5.3.11. Additional measures.

- All trees which will be used at reconstruction works, will be ordered in special nurseries
- Solid waste products (distinct from repair - regenerative) such as trees, a paper, a glass, plastic and stuff in general, will be properly collected, divided and taken out in places allowed for their warehousing.
- All building sites will be kept clean and in good sanitary conditions.

6. Cost, management and monitoring of Environmental Mitigating Action Plan (EAP)

The Environmental Mitigation Action Plan (EAP) consists of three basic sections:

1. Observance of nature protection requirements at works on repair, reconstruction and restoration of main, distributive networks and constructions.
2. Realization of actions for economy and rational use of water resources during the process of exploitation (liquidation of leakages, conducting the account of water measuring, mechanisms of stimulating water-users on economy of water and etc.)
3. Realization of actions to fight pollution of underground and superficial waters in a modern valley of the river Zaravshan.

Approximate expenses for realization of the Action Plan in addition to the normal operations and maintenance works of SVK and BVK include:

<table>
<thead>
<tr>
<th></th>
<th>Thousand US dollars</th>
<th>Bukhara</th>
<th>Samarkand</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Repair-reconstruction works.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Cost of the monitoring equipment, stock and works</td>
<td>14,6 18,4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Development and introduction of projects works providing safety</td>
<td>14,8 16,5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Maintenance of safety precautions and labor protection</td>
<td>12,9 13,6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II. Operation and maintenance service</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Improvement of water quality, including additional equipment for chlorine system</td>
<td>19,2 17,1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Conducting of monitoring of drinking water quality (sampling, laboratory analyses, methodic)</td>
<td>26,1 23,4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Conducting of monitoring of underground and superficial waters state in a modern valley of river Zaravshan (purchase of devices, equipment, reactants, vehicles, training of personnel)</td>
<td>17,7 26,7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Development and realization of monitoring plan and protection of water-in taking constructions</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
and water-purifying constructions 6,9 7,3  
5. Environmental Awareness 2,1 3,6  
6. Protection of trees and vegetative cover 8,9 10,2  
8. Training of personnel on environmental actions 5,2 6,0  

**Total:** 112,6 136,2

The expenses do not include surcharges or construction contracts to implement repair-reconstruction works.

Actions for first and second sections of the Action Plan will be implement by nature protection services of SVK and BVK during repair – reconstruction works and objects exploitation. The Operator will supervise these works, in frame of service contract.

The state control for observance of nature protection requirements, is implemented by bodies of Goskompriroda (regional committees for nature protection) and Sanitary-Epidemiological service of Ministry of Health.

Works providing under the third section of the Action Plan, including on itself definition of water-protected zones and giving of status of especially protected natural territories to zones of formation of field of fresh underground waters (sources of drinking water supply) in the modern valley of the river Zaravshan; taking out from water-protected zones the ecological potentially dangerous objects of pollution; conducting of monitoring of state of superficial and underground waters and polluted sources of river Zaravshan; realization of nature protection actions at the separate enterprises - sources of pollution, is assigned to bodies of local authorities and to specially authorized state bodies (Goskompriroda, Ministry of Health, Ministry of Agriculture, Ministry of Geology, UzGlavgidromet and etc.). For realization of specified works the special Resolution of Government of the Republic of Uzbekistan has been prepared.

### 7. Coordination and publication of the EAP.

Prepared EAP includes various departments and organizations, which have to implement its realization and management in view of minimization of impact on environment. For interdepartmental coordination, public acquaintance with impact of Project realization on environment and control organization under works realization, the discussion of EAP took place with Hokimiyats, SVK, BVK and with public organizations.

Public Discussion of the EAP took place on the 5th of July, 2001 in Samarkand and on the 9th of July in Bukhara. All stated remarks and offers which have arisen during discussion, were included into the Action Plan.

Copies of the Action Plan were submitted to Hokimiyats’ libraries, water-channels and the state supervising organizations.
Table 1. Quality of river Zaravshan water (given inspections of May, 11-18, 2001)

<table>
<thead>
<tr>
<th>Observably components</th>
<th>Pervomayskaya Dam</th>
<th>Akdarynsky water-decycle</th>
<th>After collector Siab</th>
<th>After Talliguljansky dam</th>
<th>After collector Chiganak</th>
<th>Post Khatyrch</th>
<th>Channel Siab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen, mg/l</td>
<td>-</td>
<td>-</td>
<td>0,192</td>
<td>-</td>
<td>0,067</td>
<td>0,6</td>
<td>0,371</td>
</tr>
<tr>
<td>Maximum Concentration Limit (MCL)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>7,9</td>
<td>-</td>
<td>18,6</td>
</tr>
<tr>
<td>Phosphates, mg/l, MCL</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0,616</td>
</tr>
<tr>
<td>Hardness, mg.Eq/l MCL</td>
<td>-</td>
<td>-</td>
<td>7,7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>8,4</td>
</tr>
<tr>
<td>Sulfates, mg/l MCL</td>
<td>-</td>
<td>-</td>
<td>163</td>
<td>219</td>
<td>182</td>
<td>182</td>
<td>181</td>
</tr>
<tr>
<td>Iron, mg/l MCL</td>
<td>0,08</td>
<td>0,081</td>
<td>0,079</td>
<td>0,079</td>
<td>0,071</td>
<td>0,071</td>
<td>0,076</td>
</tr>
<tr>
<td>Cooper, mkg/l MCL</td>
<td>1,0</td>
<td>1,3</td>
<td>3,1</td>
<td>2,2</td>
<td>3,2</td>
<td>3,0</td>
<td>3,2</td>
</tr>
<tr>
<td>Mercury, mkg/l MCL</td>
<td>0,2</td>
<td>0,04</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Phenols, mg/l MCL</td>
<td>0,01</td>
<td>0,01</td>
<td>0,02</td>
<td>0,02</td>
<td>0,05</td>
<td>0,03</td>
<td>0,02</td>
</tr>
<tr>
<td>Fluorides, mg/l MCL</td>
<td>0,04</td>
<td>0,06</td>
<td>0,18</td>
<td>0,17</td>
<td>0,12</td>
<td>0,13</td>
<td>0,26</td>
</tr>
</tbody>
</table>
Table 2. A chemical structure of a water cites Samarkand and Bukhara.

<table>
<thead>
<tr>
<th>The name of an ingredient</th>
<th>Unit of measure</th>
<th>The water intakes city Samarkand (wellfields)</th>
<th>The water intakes city Bukhara (surface)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Chupan-Ata</td>
<td>Dagbit</td>
</tr>
<tr>
<td>Tubidities</td>
<td>Mg/l</td>
<td>0.20</td>
<td>0.30</td>
</tr>
<tr>
<td>PH</td>
<td></td>
<td>7.5</td>
<td>8.2</td>
</tr>
<tr>
<td>Oxidizability</td>
<td>Mg/l</td>
<td>15.0</td>
<td>16.4</td>
</tr>
<tr>
<td>Sulphates</td>
<td>Mg/l</td>
<td>215</td>
<td>123</td>
</tr>
<tr>
<td>Chlorides</td>
<td>Mg/l</td>
<td>17.0</td>
<td>137</td>
</tr>
<tr>
<td>Rigidity</td>
<td>Mg-equ/l</td>
<td>5.30</td>
<td>6,20</td>
</tr>
<tr>
<td>Salinity</td>
<td>Mg/l</td>
<td>433</td>
<td>433</td>
</tr>
<tr>
<td>Azot ammonium</td>
<td>Mg/l</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Azot nitrite</td>
<td>Mg/l</td>
<td>No</td>
<td>no</td>
</tr>
<tr>
<td>Azot nitrate</td>
<td>Mg/l</td>
<td>7.50</td>
<td>7.50</td>
</tr>
<tr>
<td>Manganese</td>
<td>Mg/l</td>
<td>0.004</td>
<td>0.004</td>
</tr>
<tr>
<td>Iron</td>
<td>Mg/l</td>
<td>0.21</td>
<td>0.10</td>
</tr>
<tr>
<td>Copper</td>
<td>Mg/l</td>
<td>0.002</td>
<td>0.006</td>
</tr>
<tr>
<td>Zincum</td>
<td>Mg/l</td>
<td>0.003</td>
<td>0.007</td>
</tr>
<tr>
<td>Cadmium</td>
<td>Mg/l</td>
<td>0.199</td>
<td>0.061</td>
</tr>
<tr>
<td>Lead</td>
<td>Mkg/l</td>
<td>1.99</td>
<td>0.57</td>
</tr>
<tr>
<td>Alkaline</td>
<td>Mg-equ/l</td>
<td>4,8</td>
<td>3,8</td>
</tr>
<tr>
<td>A-Chlorocyclohexene</td>
<td>Mkg/l</td>
<td>0.002</td>
<td>No</td>
</tr>
<tr>
<td>4/4-Dichlorine diphenyl trichlorometilmetan (DDT)</td>
<td>Mkg/l</td>
<td>0.015</td>
<td>No</td>
</tr>
</tbody>
</table>

*See Appendix 1 and 2 for location of intakes*
Table 3. The Plan of Nature protection measured

<table>
<thead>
<tr>
<th>Stage</th>
<th>Problem</th>
<th>Corrective actions</th>
<th>Responsible organizations</th>
<th>Monitoring</th>
<th>Responsible organizations on monitoring for works implementation(by way of participation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repair-reconstruction works</td>
<td>Environment</td>
<td>For complex objects-development of components of the project works manufacture; introduction of new effective materials and designs, technologies of conducting works; observance of repair-reconstruction norms and rules; storage of silt only in special places.</td>
<td>Contractors</td>
<td>Current technical repair-reconstruction control and supervision</td>
<td>Operator; SVK and BVK; coordinators of the project in Samarkand and Bukhara, local agencies of conducting repair-reconstruction works, local bodies for nature protection, geology and agriculture and water economy.</td>
</tr>
<tr>
<td>Repair and restoration of water equipment, network and pipelines</td>
<td>Pollution of ground water (superficial or earth) sediments from water treating on clearing constructions, pipes and network units</td>
<td>Providing of pipe-bend of a superficial and drainage drain from working sites, their timely clearing from the repair-reconstruction wastes products, realization of reconstruction works on the broken sites.</td>
<td>Contractors</td>
<td>Periodically, during repair-reconstruction works</td>
<td>Operator; SVK and BVK; Coordinators of the Project; local agency on supervision for conducting repair-reconstruction works, local bodies for nature protection and geology.</td>
</tr>
<tr>
<td></td>
<td>Pollution of subsoil waters by superficial drain from building sites</td>
<td>Organization of timely gathering of repair-reconstruction wastes, their transport and storage in special sites.</td>
<td>Contractors</td>
<td>Periodically, during repair-reconstruction works</td>
<td>Operator; SVK and BVK; Coordinators of the Project; local agency on supervision for conducting repair-reconstruction works, local bodies of Sanitary-Epidemiological Station for nature protection.</td>
</tr>
<tr>
<td></td>
<td>Soil and water pollution by construction waste products</td>
<td>Capacities for fuel materials should be filled according to setting norms; not to allow the spill of some used oil-products, to observe the rules of refuelling and transportation</td>
<td>Contractors, working mechanisms</td>
<td>Current control during repair-reconstruction works</td>
<td>Operator; SVK and BVK; Coordinators of the Project; local agency on supervision for conducting repair-reconstruction works, local bodies of Sanitary-Epidemiological Station for nature protection.</td>
</tr>
<tr>
<td>Stage</td>
<td>Problem</td>
<td>Corrective actions</td>
<td>Responsible organizations</td>
<td>Monitoring</td>
<td>Responsible organizations on nature protection</td>
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<tr>
<td></td>
<td>Pollution of atmospheric air by dust</td>
<td>Watering of roads, repair-reconstruction sites of works and the appropriate covering for transport of wastes products.</td>
<td>Contractors, drives of the appropriate machines</td>
<td>Periodically, during repair-reconstruction works</td>
<td>Operator; SVK and BVK; Coordinators of the Project; local agency on supervision for conducting repair-reconstruction works, local bodies for nature protection</td>
</tr>
<tr>
<td></td>
<td>Damage of trees and vegetative cover</td>
<td>All destroyed vegetation is a subject of restoration. All decorative trees damaged during repair-reconstruction works will be replaced.</td>
<td>Contractors</td>
<td>After works’ finishing</td>
<td>Operator, SVK and BVK; Coordinators of the Project, local agency on supervision of conducting repair-reconstruction works, local bodies for nature protection</td>
</tr>
<tr>
<td></td>
<td>Chance findings of cultural resources</td>
<td>Stop doing of works, notification of the interested organizations, collection according to established rules.</td>
<td>Contractor</td>
<td>Constantly, in process of tacking out</td>
<td>Project operator; SVK and BVK; responsible bodies for safety of ancient monuments and cultural values</td>
</tr>
<tr>
<td>Social and economic</td>
<td>Safety and healthy working conditions, exception of failures and accidents</td>
<td>Providing of safety precautions regulations, labor safeties by correct choice and technically substantiated sizes of workplaces and their organization</td>
<td>Contractor</td>
<td>constantly</td>
<td>Operator; SVK and BVK; Project coordinators, local agency on supervision of conducting repair-reconstruction works.</td>
</tr>
<tr>
<td>Operation</td>
<td>Environment</td>
<td>Clearing constructions for water-preparation</td>
<td>Workers of clearing constructions, SVK and BVK</td>
<td>Regularly</td>
<td>Operator, local personal SVK and BVK, bodies for nature protection, Sanitary Epidemiological Station</td>
</tr>
<tr>
<td></td>
<td>Clearing constructions for water-preparation</td>
<td>Pollution of ground and water by silt sediment</td>
<td>Workers of clearing constructions, SVK and BVK</td>
<td>Regularly</td>
<td>Operator, local personal SVK and BVK, bodies for nature protection, Sanitary Epidemiological Station</td>
</tr>
<tr>
<td>Water leakage</td>
<td>Loss of water resources, water pollution, flooding</td>
<td>Timely failure detection on a network, quick burst repair, control for observation of water delivery norms</td>
<td>Local personnel SVK and BVK</td>
<td>Periodical control</td>
<td>Operator, local personal SVK and BVK, bodies for nature protection, Sanitary Epidemiological Station</td>
</tr>
<tr>
<td>Stage</td>
<td>Problem</td>
<td>Corrective actions</td>
<td>Responsible organizations</td>
<td>Monitoring</td>
<td>Responsible organizations on implementation (by way of participation)</td>
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<tr>
<td></td>
<td>Operation of water-intaking constructions and water supply systems</td>
<td>Pollution of water resources</td>
<td>To develop ecological and other criteria, regulating as much as possible safe loads on environment, timely; To observe protection of water (sources of water intaking) from pollution, contamination and exhaustion To provide technological, forest amelioration, hydro technical, sanitary-engineering actions agreed with bodies of state control; To implement the dump of household, drainage and other sewage from the sanction of nature protection bodies in definite order; By using of underground waters to provide the supervision over their mode, quality and the account on a site of a water in-taking, development of actions for protection of underground waters; To observe a sanitary zone of protection on water in-taking points; To introduce without-waste and less-waste technologies, to reduce formation of waste products of manufactures and life, to make their disinfecting, processing; To observe rules of their sorting, storage, burial place and utilization</td>
<td>Local personal SVK and BVK</td>
<td>Periodical control</td>
</tr>
</tbody>
</table>

**Social and economic**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Problem</th>
<th>Corrective actions</th>
<th>Responsible organizations</th>
<th>Monitoring</th>
<th>Responsible organizations on implementation (by way of participation)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operation of water in-taking constructions and water supply systems</td>
<td>State of work’ precautions of safety and hygiene</td>
<td>To develop the complex program on improvement of state of precautions of safety and hygiene of work for the attendants</td>
<td>Local personal SVK and BVK</td>
<td>Periodical control</td>
</tr>
<tr>
<td></td>
<td>Disinfecting of drinking water</td>
<td>Threat to health of working personnel</td>
<td>Exploitation of chlorine equipment and storage of chlorine stocks with the observance of certain norms</td>
<td>Local personal SVK and BVK</td>
<td>Constant control</td>
</tr>
<tr>
<td>Stage burned</td>
<td>Problem</td>
<td>Corrective actions</td>
<td>Responsible organizations</td>
<td>Monitoring</td>
<td>Responsible organizations on monitoring for works implementation(by way of participation)</td>
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<tr>
<td><strong>Additional measures</strong></td>
<td>Environment</td>
<td>Setting of water protection zone of the river Zaravshan and taking out of it ecologically dangerous objects</td>
<td>Pollution of water resources</td>
<td>Preparation of the Resolution of the Government of Uzbekistan about creation of a common water protection zone (WPZ) of the river Zaravshan; taking out from WPZ of pollution sources, determined by the Resolution</td>
<td>Hokimiyats, bodies for nature protection, Goscomseem, regional agriculture and water committee, heads of enterprises</td>
</tr>
<tr>
<td>Giving of the status of especially protected natural territory to zones of formation of fresh underground waters of modern valley river Zaravshan</td>
<td>Pollution of fresh underground waters</td>
<td>Preparation of the Resolution about giving the status; observance of a favorable water mode and economic activities in especially protected zone.</td>
<td>Goscompriroda, Goscomgeologia</td>
<td>Periodical control</td>
<td>Goscompriroda, Goscomgeologia</td>
</tr>
<tr>
<td>Organization of the post of automatic control of water quality with hydrochemical laboratory on border of the Republic of Uzbekistan with Republic of Tajikistan</td>
<td>Pollution of water entering into Republic of Uzbekistan from the territory of Tajikistan</td>
<td>Organization of automatic monitoring of quality of waters acting on border of Uzbekistan and Tajikistan; timely acceptance of measures at deterioration of waters.</td>
<td>GEF, Agency, UzGlavgidromet</td>
<td></td>
<td>Goscompriroda,Goscomgeologia</td>
</tr>
<tr>
<td>Stage</td>
<td>Problem</td>
<td>Corrective actions</td>
<td>Responsible organizations</td>
<td>Monitoring</td>
<td>Responsible organizations on monitoring for works implementation(by way of participation)</td>
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<tr>
<td>Equipment of hydrochemical monitoring laboratories UzGlavgidromet, territorial Committee for nature protection, geology, SES</td>
<td>Absence of monitoring for specific components</td>
<td>Equipment of laboratories devices and techniques for definition of specific components (selenium, strontium, cobalt, antimony, mercury and other)</td>
<td>Ministry of Finance, Ministry of Macroeconomic and statistics, UzGlavgidromet, Goscompriroda, Ministry of Health, Goscomgeology</td>
<td>Regularly</td>
<td>UzGlavgidromet, Goscompriroda, Goscomgeology, Ministry of Health</td>
</tr>
</tbody>
</table>
LOCATION OF WATER PRODUCTION FACILITIES (BUKHARA)

Legend:  PS.....pumping station
         FS.....filter station
         WF.....wellfield
Appendix 2

LOCATION OF WATER PRODUCTION FACILITIES (SAMARKAND)

Scheme of the Dagbit production facilities is given below whereas the Chapanata Wellfield is constructed similar.
Appendix 3

Organization structure of Goscompriroda of the Republic of Uzbekistan
Structure of regional committees for nature protection

<table>
<thead>
<tr>
<th>PUBLIC COUNCIL</th>
<th>GOVERNING BODY</th>
<th>COMMITTEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial and technical department</td>
<td>Ecological examination department</td>
<td>Standardization, organize nature utilization department</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Promotion of scientific and technical progress department</td>
</tr>
</tbody>
</table>

Inspection services of Karakalpakstan and Regions

<table>
<thead>
<tr>
<th>Analytic control inspection</th>
<th>Mining relations inspection</th>
<th>Atmosphere protection inspection</th>
<th>Inspection to protect and efficient use land reserves</th>
<th>Inspection to protect flora and fauna</th>
<th>Inspection to protect and efficient use water reservoirs</th>
</tr>
</thead>
</table>

City, interdistrict and district committees (inspections)

<table>
<thead>
<tr>
<th>Regional committee for nature protection</th>
<th>City committee for nature protection</th>
<th>Interdistrict committee for nature protection</th>
<th>District committee for nature protection</th>
</tr>
</thead>
</table>
Appendix 5

Environmental Legislation in Uzbekistan: List of Main Legal Acts

Constitution of the Republic of Uzbekistan as of December 8, 1992

Land Legislation


Resolution of the Cabinet of Ministers of the Uzbek SSR, № 416 “On Procedure of Keeping the State Land Cadastre”, June 24, 1977

Resolutions of the Cabinet of Misters under the President of the Republic of Uzbekistan “On Approval of the Regulations of Water Protection Zones of Water and Other Reservoirs, Rivers, Main Channels and Collectors as well as the Supply Sources of Water for Drinking and Everyday Use, Treatment and Health Improvement Purposes in the Republic of Uzbekistan”, № 174, April 7, 1992

Resolution of the Cabinet of Ministers “On the Approval of Regulations on the Procedure of Settlement of Land Disputes in the Republic of Uzbekistan” № 245, May 25, 1992


Resolution of the Cabinet of Ministers of the Republic of Uzbekistan “On Approval of the Procedure of Calculation of the Size of Loss and Compensation of Loss of Agricultural and Forestry Entities In Connection with the Land Withdrawal for Purposes Not Linked with Agriculture and Forestry”, № 282, June 15, 1992


Decree of the President of the Republic of Uzbekistan “On Initiation and Incentives for Private Entrepreneurship”, YHI-1030, January 5, 1995


Decree of the President of the Republic of Uzbekistan “On the Improvement of Efficiency of the Use of Land”, November 24, 1994


Resolution of the Cabinet of Ministers of the Republic of Uzbekistan “On Procedure of Selling Trading and Service Unite into the Private Ownership together with Plots of Land on Which They are Located and the Plots of Land - into Life-Long Inherited Ownership”, № 126, April 11, 1995


Resolution of the Cabinet of Ministers of the Republic of Uzbekistan “On Measures for Arrangement of the Use of Underground Waters, Enhancement of Their Protection from Contamination and Depletion”, № 179, April 8, 1992
Ecological Assessment of the Samarkand and Bukhara Water Supply Improvement Project


**Flora, Fauna Protection and Use Legislation**


**Legislation on Specially Protected Territories**

1. Law of the Republic of Uzbekistan “On Specially Protected Natural Territories”, May 7, 1993

**Legislation on Atmospheric Air Protection**