Republic of Uzbekistan

Bukhara and Samarkand Sewerage Project

DRAFT REPORT ON ENVIRONMENTAL IMPACT ASSESSMENT

of reconstruction of wastewater treatment plants and sewerage network
of the city of Bukhara

Tashkent
February-May 2009
ABBREVIATIONS AND ACRONYMS:

WB  World Bank
RU  Republic of Uzbekistan
CM  Cabinet of Ministers
GoU Government of Uzbekistan
IBRD International Bank for Reconstruction and Development
IDA International Development Association
BSSP Bukhara and Samarkand Sewerage Project
BSWSP Bukhara and Samarkand Water Supply Project (WB)
ADB Asian Development Bank
UNESCO United Nations Education Science and Culture Organization
REIA Report on Environmental Impact Assessment
DMC “Donaev Management Consulting” LLC, Uzbekistan (Consultant)
EMP Environmental Management Plan
PCU Project Coordination Unit
VK Vodokanal
WWTP Waste water treatment plant
WWPS Waste water pumping station
AIS Agency of Irrigation Systems
AMC Agency of Main Channels
CDW Collector and Drainage Waters
CIS Commonwealth of Independent States
EA Environmental Assessment
FS Feasibility Study
GWL ground water level
HGAE Hydro-Geo-Ameliorative Expedition
MAL Maximum admissible level
MAWR Ministry of Agriculture and Water Resources
MOM Manual on Operation and Maintenance
NGO Non-Governmental Organization
O&M Operation and Maintenance
OP Operational Policy (WB)
PIU Project Implementation Unit
SA Social Assessment
SEE State Ecological Expertise
ToR Terms of Reference
USD United States Dollar
UZS Uzbek Soum
VDW Vertical Drainage Well
EE Ecological Expertise
EIA Environmental Impact Assessment
PCR Cultural Resource
Uzgидротем Centre of hydrometeo service under the Cabinet of Ministers of the Republic of Uzbekistan
Goskompriroda State Committee of the Republic of Uzbekistan on Protection of Environment (Nature)
Uzкommунхизмat Uzbek Communal Services Agency
Glavgosekspertiza Main Department of Environmental Expertise of Goskompriroda
CAR Central Asian Region
GW Ground waters
SK Sewerage collector
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tr>
<td>WPI</td>
<td>Water pollution index</td>
</tr>
<tr>
<td>DDT</td>
<td>4,4 – Dichlordiphenyltrimethylmethane-insecticide</td>
</tr>
<tr>
<td>HCCH</td>
<td>Hexachlorocyclohexane</td>
</tr>
<tr>
<td>gamma-HCCH</td>
<td>Hexachlorocyclohexane, gamma-isomer-insecticide</td>
</tr>
<tr>
<td>alpha-HCCH</td>
<td>Hexachlorocyclohexane, alpha-isomer-insecticide</td>
</tr>
<tr>
<td>BOD</td>
<td>Biochemical Oxygen Demand</td>
</tr>
<tr>
<td>COD</td>
<td>Chemical Oxygen Demand</td>
</tr>
<tr>
<td>MAC</td>
<td>Maximum admissible concentration of polluting substances</td>
</tr>
<tr>
<td>SSAM</td>
<td>synthetic surface active material</td>
</tr>
<tr>
<td>ha</td>
<td>hectare</td>
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<tr>
<td>km</td>
<td>kilometer</td>
</tr>
<tr>
<td>KW</td>
<td>Kilowatt</td>
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<tr>
<td>m</td>
<td>Meter</td>
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1. INTRODUCTION

1.1. General Provisions

The Government of Uzbekistan actively implements a long-term strategy on improvement of drinking water supply to population in rural areas and towns of the republic, on improvement of sanitary conditions of wastewater treatment plants and drainage facilities within the framework of projects on the basis of privileged loans of international financial institutions and other donor countries as well as own efforts. In accordance to the Decree of the CM of the Republic of Uzbekistan No 405 as of 17/09/2003, a long-term Program on drinking water supply to population of 2323 rural settlements has been approved and is being implemented. As a result of current program implementation and as to the beginning of 2008, 1413 rural settlements are covered by drinking water supply. Also during 2006-2008 systems of drinking water supply were reconstructed in 2223 rural areas, where 4.4 million people. In the regions (many oblasts and raions across the country as well as in project area), where quality of ground and surface waters do not correspond to the requirements for drinking use in order to improve the situation with water supply to population interregional water supply pipes (1954 kilometers of total length) were installed.

Continuously with potable water supply to settlements, acutely stands the issue with regard to condition of sewerage and wastewater treatment infrastructure in towns of the republic, and, accordingly, negative impact of dilapidated sewerage facilities on surrounding environment and neighboring areas. Thus, this adversely affects potable water quality, due to pollution of rivers and underground water. At present, according to “Uzkommmunkhizmat” data, only 69 out of 217 towns and urban-type settlements has sewerage systems installed. So, 51.5% of the population of those towns uses services of sewerage. At the republican scale 14.1% of the population uses services of sewerage.

With the purpose of eliminating existing problems and improving sanitary epidemiological situation GoU planned to implement priority projects for the period of 2009-2012 included by the Decree of the President of the Republic of Uzbekistan as of 12/06/2008 No PP-890 “On the Measures of Further Improvement of Provision of Population in Rural Areas and Towns with Qualitative Potable Water and Rational Use of Natural Gas”. Particularly, the following projects directed to improvement of potable water quality and modernization of sewerage systems in Bukhara and Samarkand regions (oblasts) will be implemented:

- Bukhara and Samarkand Water Supply Project (IBRD/IDA, 2004-2009);
- Bukhara and Samarkand Sewerage Project (IBRD/IDA);
- Improvement of Potable Water Supply to Alat and Karakul raions of Bukhara region (IBRD, 2010-2012);
- Modernization of Damkhoja Interregional Water Supply Pipeline with connecting of raion centers and rural settlements of Samarkand, Bukhara and Navoi regions to it (ADB, 2009-2012);
- Reconstruction of water supply system for raion centers of Kasan and Mubarek as well as rural settlements neighboring to water pipe line from Kitab-Shakhrisabz deposit of underground waters (Privileged loan of China for member states of Shanghai Cooperation Organization, 2009-2012);
- Water Supply of Kushrabot raion of Samarkand region (Eximbank of Korea/EDCF Fund, 2010-2012)

Serious support to initiatives of GoU is provided by the WB and its institutes during more than 10-year cooperation. Within medium-term perspective Uzbekistan and WB intend to lay foundation for further dialogue in developing the sector at hand, taking into account gained experience and projects
implemented. Particularly, WB has planned to draft the Concept on water supply and sanitation sector development till February of 2009 and conduct a strategic event at the end of first quarter of 2009 with participation of national and international stakeholders that are actively involved in the process of sector modernization.

1.2. Objectives of the Project

GoU and khokimiyat of the city of Bukhara with the purpose to improve conditions of environment and of public health, related to insufficient cleaning of wastewater in both cities and within the framework of implementing a long-term program on improvement of water supply and sanitation in those cities, requested a loan from WB to support Project on modernization of sewerage systems.

The main project objective is rehabilitation of sewerage system with purpose to reduce leakages and expand area of coverage to selected city districts and enhancing effectiveness of WWTPs, reducing pollution level to environment. The proposed Project will be directed to reduce the level of pollution of environment by:

- Increasing number of connections to sewerage system will reduce volume of waste waters, discharged by population without treatment to the landscape area;
- Modernizing technological process at WWTPs;
- Increasing service life period of WWTPs and its equipment by means of reconstruction and replacement;
- Bringing into conformity to quality standards of the RU set for treated wastewater.

1.3. Background of the Project

Sewerage network of the city is much deteriorated. Infrastructure became dilapidated, on going physical destruction of lines, seepage of raw sewage into the ground, frequent sewer blockages. All that is a result, first of all, of the fact that operating WWTPs and existing network were built 30-40 years ago, namely in times of Soviet Union. After 15 years from acquiring the Independence the whole complex of sewerage infrastructure reached a critical point and as a result, it leaded to moral and physical deterioration of components of existing electrical and mechanical equipment at WWTPs. Fixed and high costs for infrastructure operation maintenance and elimination of accidents at different sections as well as increased electric power consumption and pollution of ground/surface waters ad soils is a sequence of existing condition of networks.

In this regard, it poses a serious risk to environmental situation in the city. As, for example, in Bukhara, approximately two thirds of whole volume of collected wastewater seeps into the ground and that poses threat to environment and population health. All that leads to disbalance and appearance of ecological and social problems puts obstacles to normal development of business and trade, creates anti-sanitary conditions for local population and many tourists visiting historical cities year by year.

The proposed Project will be an initial step in stage-by-stage approach towards enhancing access and effectiveness of sewerage systems and will be directed to address most urgent needs of rehabilitation.
and expansion of network. Works will include replacement of existing discharge pipes and expansion of network to currently unconnected areas; rehabilitation of pumping stations; and repair of a part of main collectors and WWTPs. At present stage WWTPs will not be expanded as only 50% of their designed capacities is exploited.

Bukhara and Samarkand Sewerage Project (BSSP) will actively use experience and achievements of ongoing BSWSP. The total estimated investment needs in Bukhara equals to about 102 million USD. Since these requirements are beyond the financial capacity of Bukhara, a staged approach is suggested. These resources will be used primarily for

- rehabilitation/expansion of 32.5 km sewers,
- rehabilitation and installation of more efficient pumps at 16 WWPSs,
- installation of a new aeration system at the WWTP to minimize energy need.

It is proposed that project phase I implementation will require 5 years.

Project will be implemented within the following components:

Components 1. Physical rehabilitation of sewerage networks in the city of Bukhara
- Rehabilitation of the existing sewerage network.
- Expansion of sewerage connections to selected areas of the city (expansion of network by installing additional sewerage lines to unconnected districts).
- Upgrading wastewater treatment plant (replacement of selected electromechanical equipment and initiate the upgrading of the plant in order to reduce O&M costs and energy consumption; undertake an energy audit of VK operations to guide a scaled-up effort in the future to reduce energy costs).

It is expected that studied project impact on environment will mainly occur from this component and at the same time it is anticipated that consequences will be mainly positive and negative ones will be temporary.

Component 2: Technical Assistance and training.
The project would finance limited technical assistance and training for staff in the two vodokanals to continue the capacity building started under the Bukhara and Samarkand Water Supply Project. It is envisaged that the technical assistance and training would focus on improving the VK's operational efficiency and consumer orientation. The technical assistance component would also finance a program from improving public cleanliness and sanitary practices, including hand-washing.

1.4. Area ( Territory) of Study

City of Bukhara is one of ancient cities in Central Asia, its 2500-year anniversary was celebrated in 1997, the city is included to the list of UNESCO global heritage, and it is one of tourist centers, which has preserved for approximately 170 architectural monuments. The most important among of them are: the masterpiece of Central Asian art of building – dynastic burial of Samanids (end of IX – beginning of X a.d.) – is the first of well-known Moslem mausoleums in Central Asia and one of the earliest in the whole East. The special place in Bukhara’s look is attributed to Minaret Kalon (Big minaret, XII). It is the highest of all famous architectural monuments in Central Asia (height 50 meters).

The basic city layout emerged depending on area relief was preserved till present days. The population of the city totals 300,000. The city is located in Zaravshan valley in the lower part of Zaravshan river basin on the right bank. The territory includes about 2.6 thousand ha and consists of single-storey and multi-storey buildings: the central part of the city (monuments of Bukhara and city itself are included in UNESCO list of global heritage. Information is taken from the Encyclopedia of the Republic of Uzbekistan and is confirmed by the Head of Bukhara regional inspection of
cultural heritage objects protection, Mr. T.Babaev) consists of old-city single-storey structures; new micro-districts in south and south-eastern part of the city are formed by multi-storey well-planned buildings.

Drawing 1.4.1 City of Bukhara, aerial photograph

Bukhara is a city of primarily light and food industries.Traditionally it is famous for gold embroidery and silk-weaving manufacture. Articles and products of local seamstresses – golden-embroidered ‘skullcaps’ (“tyubeteyka”), artistic panels, handbags, shoes are famous places a long distance far from Uzbekistan. The only in Uzbekistan and one of the biggest in fur industry karakul processing factory manufactures black-, grey- and gold-colored karakuls, production of this factory is exported to a number of foreign countries. The following enterprise operate in the city: big cotton fabric factory, gin plant, oil pressing factory, silk-reeling factory and construction industry and food industry enterprises.

In Bukhara water supply covers 98% of city population, though, only half of total number of consumers uses sewerage services. The remaining residents use cesspools and cesspool cleaning services. The centralized system of wastewater collection based on biological processes operates in Bukhara. Existing capacity of treatment facilities of Bukhara city totals 100 thousand cubic m/per day. Discharge of effluent in Bukhara city is carried out via a collector in the extent of 2 kms to Sakovich collector.

The population not using sewerage and a collector flowing over the territory of Bukhara city provides a negative impact to Zaravshan River though pollution of ground waters.
2. EIA METHODOLOGY

The common environmental assessment methodology includes certain stages of environmental assessment. The most important of them are the following:

- Identification of main problems
- Determination of these problems' scale
- Mitigation measures
- Management and monitoring

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

The following ecological aspects have been considered:

- Water resources
- Land resources
- Ecological resources
- Social aspects
- Physical cultural heritage

This report provides a general environmental assessment of the anthropogenic impact at implementation of the Bukhara and Samarkand Sewerage Project in the city of Bukhara including the Environmental Management Plan.

2.1. WB EIA Requirements

According to WB Operational Policy, the project will be evaluated within the framework of environmental assessment from the point of impact on project territory and also ways of project design improvement and implementation by means of prevention, minimization or possibly elimination of negative environmental impact and positive impact increase will be defined.

According to type of environmental analysis of the WB, level of detail of environmental analysis depends on scope and environmental impact of proposed works. Categories selected in accordance with the type of investments and related level of environmental impacts are stated below:

- Category A: full EA with EMP is required;
- Category B: it is necessary to provide a recent environmental analysis (although full EA is not required) and EMP;
- Category C: EA or environmental analysis is not required.

The proposed project is classified as EA Category «B» (according to OP/BP 4.01 of the WB Safeguard Policies) for possible negative impacts that may occur during the project implementation. Thus, the project requires an environmental impact assessment (EIA) prepared before project appraisal. Environmental assessment of Category «B» is required due to the civil works proposed regarding water resources usage, expansion/rehabilitation on treatment facilities and sewerage network.

The results of this Environmental Assessment (EA) confirm that proposed project arrangements will have a general positive environmental impact. In the process of project implementation there expected to be temporary and local disturbances (negative impacts) in connection with construction and rehabilitation works, but it is expected that in the majority of cases these impacts can be reduced by implementing proper construction standards.
2.2. Uzbekistan EIA Requirements


Objects and categories of their environmental impact are provided by above-stated documents, to be subjected to state environmental expertise. Objects subjected to the expertise, are to be subjected to four categories of environmental impact.

- Category 1 – high risk;
- Category 2 – mean risk;
- Category 3 – low risk;
- Category 4 – local impact.

Types of activity are given in details for each category in Attachment 2 of the Regulation. Category 2 of environmental impact (average risk) includes item 16 “Sewerage treatment facilities with a capacity of 50-200 thousand cubic meters per day”, which is applicable for the present Project (capacity of Bukhara city wastewater treatment facilities comprises 100 cubic meters per day).

State ecologic assessment is conducted by specialized departments of unique system of State Department of Ecologic Expertise of the State Nature Protection of the Republic of Uzbekistan in order to determine conformity of outlined or implemented commercial activity to ecologic requirements.

Main State Department of Ecologic Expertise conducts environmental assessment of:

- Objects related to I and II categories;
- Draft state programs, concepts, schemes of production capacity allocation and development;
- Urban planning documents for the objects with population more than 50 thousand people;
- Documents on elaboration of new types of machinery, techniques, materials, substances, products;
- Draft technological normative and instructional methodic documents regulating activity related to nature resources use.

Objects related to III and IV categories as well as urban planning documents for the objects with population of 50 thousand people and less are considered by state expert agencies of the Nature Protection Committees of the Republic of Karakalpakstan, regions and Tashkent city.

The below-mentioned is submitted for ecologic expertise:

- As for designed objects (pre-project and project documents; all types of urban planning documents; objects of special control) – materials of environmental impact assessment (EIA), containing the following stages:
  - Draft declaration on environmental impact, which is implemented at the stage of designing scheduled or forecasted commercial or another activity, before commencement of project financing;
  - Declaration on environmental impact, which is implemented in case when by the results of environmental assessment of draft declaration on environmental impact, the necessity in conducting additional investigation, nature observations, special analysis, model experiments and development of reasonable nature protection measures was established. Declaration on environmental impact is submitted prior to approval of feasibility study of the object;
• Declaration on environmental consequences, which is implemented prior to acceptance of the object for operation and is final stage of environmental impact assessment of designed objects.

- As for operating objects (operating enterprises and other objects impacting negatively on environment and population health) – materials of environmental measurement (plans of maximum admissible emissions of pollutants into the atmosphere, discharges to surface pools and area landscape, norms of formation and disposal of wastes), declaration on environmental impact developed in case of establishment of object impact on environment and population health. Customer may additionally submit the results of environmental audit.

Such an approach supposes implementation of sectoral assessment, elaboration of measures directed to lessen environmental impact as well as environmental monitoring.

Enterprise or any other organization (institutes, companies with such experience, private experts, etc, may be engaged) implements the arrangement and conduction of environmental assessment, whereas Glavgosekspertiza implements expertise of submitted reports on environment impact assessment and issues conclusion in the order prescribed.
3. ORGANIZATIONAL, LEGAL AND POLICY FRAMEWORK FOR PROJECT IMPLEMENTATION

3.1 Legal regulation

a) National legislation on Protection of the Environment

A legal basis in the sphere of protection and the use of environment has been established in Uzbekistan, which is aimed at guaranteeing rights and duties stipulated by Articles 50 and 55 of the Constitution of the Republic of Uzbekistan. These are over than 20 laws, approximately 50 decrees of the President and of the Cabinet of Ministers of the Republic of Uzbekistan as well as other subordinate acts and normative documentation.

With regard to the present project, the following basic legal acts are acting at present in Uzbekistan that are directed to provide environment protection, guaranteeing public healthcare as well as managing the environment protection sector, namely Laws of the Republic of Uzbekistan:

- "On the protection of the environment" (1992);
- "On water and water use" (1993);
- "On the State Environmental Expertise" (2000);
- "On the State sanitary epidemiological supervision in the Republic of Uzbekistan" (1992);
- "On the protection and use of objects of cultural heritage" (2001)
- "On special protected areas" with amendments (30.08.93)
- "On protection and use of flora" (as of 26 December 1997)
- "On protection and use of fauna" (as of 26 December 1997)
- "On protection of atmospheric air" (as of 27 December 1996)
- "On wastes" as of 05/04/2002
- "On protection of the population and areas from emergency situations of natural and anthropogenic character" as of 20/08/1999.

The key acting subordinate acts and normative documents adopted by the Government of Uzbekistan in the sphere of environment protection are as follows:

- “On adoption of the Regulation on State Environmental Expertise” (No 491, 31/12/2001);
- “On adoption of the Regulation on State Environmental Monitoring” (No 49, 3/04/2002);
- “On assigning the status of special protected areas to zones of sources formation of fresh ground waters” (No 302, 26/08/2002);
- "Regulation on water protection zones of water reservoirs and other natural pools, rivers, trunk channels and collectors as well as of drinking and household water supply sources, including of medical, cultural and health improvement purposes in the Republic of Uzbekistan", 07/04/92.
- "On introduction of fees for excessive discharges (emissions) of polluting substances to the environment and solid wastes removal", 29/06/92.
- “The order of elaboration and fulfilling project standards on maximum permissible emissions of polluting substances to water objects including drainage waters” (RD-118.0027719.5-91);
- “The order of issuing permissions for special water use” (RD-118.0027714.6-92);
- “Instruction on determining of damage caused to the national economy by polluting ground waters” (RD-118.0027714.47-95);
b) Governmental policy on environment protection

The Government of Uzbekistan under assistance of international organizations and direct support from NGOs has developed and now implements the following programs, strategies and action plans related to activities fulfilled within the present project:

- The Program on protection of environment in the Republic of Uzbekistan for the years of 2008-2012;
- The Program of provision of the population in rural raions and towns with qualitative drinking water and efficient use of natural gas;
- Investment program of the Republic of Uzbekistan for the years of 2008-2012.

c) International agreements in the sphere of nature protection and prevention of transboundary impacts

Within the framework of cooperation in the sphere of environmental management, Uzbekistan has ratified key conventions adopted in Rio-de-Janeiro: Framework Convention on climate change, Convention on biological diversity and Convention on fighting against desertification as well as row of other conventions, agreements and memoranda of mutual understanding in the sphere of environment protection and sustainable development. As applied to the present project Uzbekistan has ratified a number of multilateral agreements directed for providing interaction with neighboring countries aimed at reducing consequences of transboundary impacts to water reservoirs of regional significance:

- Convention on protection and use of transboundary waterways and international lakes, Helsinki, 17 March 1992 (Decree of the President of the RU as of 9 August 2007 No PP-683, came into force – 3 December 2007);
- Basel Convention on control of transboundary carriage of dangerous wastes and their removal (22/12/1995);
- Convention on prohibition of military or any other hostile use of means of impacts to natural environment (26/05/1993);

Within the framework of CIS cooperation Uzbekistan is the member of Interstate Environmental Council on harmonization of environmental legislation, elaboration of EA and development of economic instruments on environmental protection as well as the member of Interstate Environmental Foundation on financing of environment protection measures within interstate and regional programs. The following key agreements have been signed:

- Agreement on interaction in the sphere of environment protection, Moscow, 8 February 1992 (coming into force on 8 February 1992);
- Agreement on cooperation in the sphere of environmental monitoring, Saratov, 13 January 1999.
- Decision of the leaders of CA countries on «Basic trends of the Program of concrete actions on improvement of environmental and socio-economic situation in Aral Sea basin for the period of 2003-2010», signed on 06/10/2002 in Dushanbe.

3.2 General national structure

According to current administrative and territorial division of the Republic of Uzbekistan, the city of Bukhara is the provincial center of Bukhara oblast.

The following three governmental bodies are considered for the purpose of the present environmental assessment actions:
• «Uzkommunkhizmat» Agency, projects organizer.
• Khokimiyats of provinces and cities, where the current project is located.
• Bukhara oblast VK, project executor.
• State Committee on nature protection (Goskompriroda), the body responsible for overall protection of environment.

Uzbek Agency "Uzkommunkhizmat"

Uzbek Agency "Uzkommunkhizmat" (and so forth as “Agency”) is a body responsible for policy development in the sector of communal servicing including coordination of organizational activities, development of standards and other guiding and technical documentation with regard to operation of sewerage networks. The activity of the Agency is regulated by the appropriate Regulations adopted by the Government of Uzbekistan. The Agency is considered as an implementing agency for the proposed project.

Local bodies of state power (regional khokimiyats)

Khokimiyat is an executive body of state power at the level of oblasts, raions and towns of the republic. Khokim heads executive and representative branches of state power on the corresponding territory and ensures implementation of acts of legislation including those related to the sector of provision of water supply and sewerage. Khokim is appointed by the President of the RU and approved by the Kengash of peoples’ deputies.

State Committee of the Republic of Uzbekistan on protection of nature

The State Committee of the Republic of Uzbekistan on protection of nature (Goskompriroda) is the basic executive body exercising functions on protection of environment and natural resources. The Committee is directly subordinated to Oliy Majlis (bicameral parliament) of the Republic of Uzbekistan and is responsible for coordination of activities of other national structures and institutions on environment protection on central, regional and raion levels.

Other corresponding governmental agencies:

• Ministry of Health of the RU is competent to exercise state sanitary supervision over observance of sanitary norms, rules and hygienic standards by all organizations located in the territory of Uzbekistan in line with bodies comprising the system of state sanitary and epidemiological supervision.

  Centers of state sanitary and epidemiological supervision provides organization and fulfillment of a complex of sanitary and epidemiological measures.

  Drinking water quality is one of these factors and is defined by nature of water supply sources, regional peculiarities of ground waters and minerals, efficiency of treatment and decontamination, degree of anthropogenic load, regime of water supply to population, etc. Since 2000, National Standard for sources of GOST-951:2000 «Sources of centralized household water supply» has been functioning in the republic. The standard sets hygienic and sanitation-technical requirements for selected sources of centralized supply. Taking into consideration multiplicity of factors defining drinking water quality, it can be resumed about «safe» supply using five words: quality, quantity, continuity, coverage and cost.

  Supervision on diseases of food nature and control of foodstuffs pollution is one of main activities of bodies of sanitary epidemiological service on nutrition hygiene.

• Republican extraordinary anti-epidemiological commission is authorized to coordinate activities of ministries, agencies, khokimiyats, economic entities directed to localizing of inflectional diseases out-breaks. The commission is entitled to control activities related to provision
of sewerage to populated areas, effective cleaning measures and disinfection of waste waters discharged to superficial water reservoirs. The Commission is authorized to prohibit or temporarily suspend operation of water supply, sewerage, hydro technical and other communal facilities.

- **Ministry of culture and sports issues of the RU** (Main scientific and production department on protection and use of objects of cultural heritage). Ministry of culture and sports issues of the RU ensures state protection of objects of cultural heritage by way of (and in addition) issuing permissions on conducting land, construction, land improvement, economic and other works on conservation of objects of cultural heritage as well as research activity on the territories of cultural heritage objects (Article 10 of the Law of the RU «On the protection of the objects of cultural heritage»).

While conducting works on construction of new objects and reconstruction of existing ones in city of Bukhara it is necessary to obtain an appropriate permission and to agree upon boundaries of an object to be constructed with the boundaries of a historical and cultural reserve defined by the Ministry of culture and sports issues of the RU on the basis of historical and cultural plans (Article 31).

### 3.3 Ecological structure

The system of bodies of state power engaged in the process of management and regulation of environment protection and governed by the Law “On the protection of nature” comprises the following:

**The Legislative Chamber and the Senate of Oliy Majlis of the Republic of Uzbekistan (Parliament)** - within the framework of joint competences in the sphere of nature protection.

**The Cabinet of Ministers of the Republic of Uzbekistan** – exercising common policy in the sphere of nature protection.

**Local bodies of state power (regional khokimiyats)** – defining key trends of nature protection on respective territories, adoption of regional (territorial) environmental programs.

**The State Committee of the Republic of Uzbekistan on protection of nature** (Goskompriroda of the RU) is a specially authorized over-ministerial and coordinating body exercising state supervision and inter-branch management in the sphere of nature protection, use and reproduction of natural sources. Goskompriroda is subordinate and accountable to Oliy Majlis of the Republic of Uzbekistan. The system of bodies is comprised as follows: Goskompriroda of the Republic of Karakalpakstan, regional (oblast) and Tashkent city committees on nature protection, inter-raion, raion and town committees (inspections) on nature protection as well as lower organizations and institutions. Goskompriroda interacts with respective nature protection bodies of other countries in solving international and regional problems including issues of polluting transboundary rivers and water reservoirs.

### 3.4 Structure of water supply and sewerage sector

**Uzbek Agency "Uzkommmunkhizmat"**

The activity of "Uzkommmunkhizmat" Agency is regulated by the Decree of the President of the Republic of Uzbekistan as of 17/08/2006, No PP-445 «On measures of improving the activity of Uzbek Agency "Uzkommmunkhizmat" and financial recovery of enterprises of communal system», which also defines the reformed system of management of issues of communal economy in the country.
Regional (oblast) vodokanals

Issues related to management of systems of water supply and sewerage are directly assigned to economically independent subjects «vodokanals», which were established specially by decisions of authorized state bodies according to territorial attribute rule. In particular, and as applied to the present project, Bukhara oblast operating department “Suvokova” acts on the basis of the right of operative management are established in the form of unitary enterprises. The activity of vodokanals is ruled by general legislation, which is applicable to regulation of economic entities of different forms of ownership. Though these organizations possess the status of natural monopolies and fall under the action of the Law “On natural monopolies”. The constituent documents – charters of vodokanals are adopted by appropriate khokimiyats.

3.5 Legal framework of civil society participation

At present, interaction of the government with environmental NGOs is conducted within cooperation with Uzbek Ecological Forum of NGOs. Uzbek Ecological Forum of NGOs (Ecoforum) is a union of environmental and environment-oriented non-governmental and non-commercial organizations and initiative groups. Its activity is directed to consolidation of public environmental organizations’ efforts in solving problems of environmental character. Tasks of Ecoforum in nature protection activity are as follows:

- elaboration of a model of joint activity within implementation of targeted programs;
- development and implementation of joint projects;
- involvement of wide publicity and population into process of implementing targeted programs;
- monitoring.

Ecoforum of non-governmental and non-commercial organizations of Uzbekistan was registered in April 2007 by the Ministry of Justice of the Republic of Uzbekistan and united environmental NGOs acting in the country. The key objective of establishing Uzbek Ecoforum of NGOs was uniting NGOs’ efforts for improvement of effectiveness of civil society participation in environment protection as well as undertaking joint actions upon solving environmental problems. In its actions directed to solve environmental problems and assist sustainable development, Ecoforum cooperates with state, international and regional organizations, NGOs and mass media. At present Ecoforum has signed memoranda on cooperation with Goskompriroda of the RU as well as other regional organizations such as RECCA. There are NGOs registered in Bukhara oblast such as Regional department of «Ecosan».

3.5.1 Legal framework of NGOs participation

In general, the basis of participation of citizens, public associations in the sphere of nature protection management is laid down by the Constitution of the Republic of Uzbekistan (Article 50, 55). Law of the RU as of 09/12/1992 «On nature protection» by Articles 12-13 regulates the right of citizens to unite in public associations on nature protection, request and receive information on the condition of environment and also measures undertaken for its protection as well as competences of established NGOs. Legislation on environmental protection stipulates civil society participation as for a) single citizen or groups of citizen; b) via citizens’ self-governing bodies and c) via non-governmental and non-commercial organizations.

Directly the participation of non-commercial nature protection organizations is ensured at the stage of environmental expertise of documentation for construction of new objects and reconstruction of existing objects with the economic purposes. Particularly, Article 27 of the Law «On nature protection», as well as Article 23 of the Law “On environmental expertise” as of 25/05/2000
provides NGOs and citizens with possibility to exercise public (social) environmental expertise of an economic activity in any sphere of sector, which needs to have environmental justification from the part of independent groups of specialist on the initiative of NGOs itself and at their own account or charge free basis. Conducting of public expertise can be implemented independently from undertaking of the state environmental expertise. It is prohibited to interfere into the process of public environmental expertise implementation. Although it is established that conclusions of public environmental expertise are considered to be of voluntary character.

Besides, upon implementation of the state environmental expertise customer organizations are obliged to publish an announcement on holding on of the state environmental expertise and of information on its results in mass media only in those cases when authorized bodies tables the object of new construction to the list of important objects.

3.5.2 Legal framework of participation of citizens’ self-governing bodies

In accordance to Article 7 of the Law “On citizens’ self-governing bodies” citizens’ self-governing bodies do not enter the system of bodies of state power, and accordingly, they represent one of forms of civil society organization. The Law “On citizens’ self-governing bodies” as of 14 April 1999 provides an opportunity for development and implementation of local initiatives including those that touch upon environmental problems.

Gathering of citizens of a rural settlement, kishlak, aul and town (city) makhalla quarterly hears the account of heads of raion, town and regional (oblast) khokimiyats on issues comprising the sphere of self-governing bodies’ competences, and also within its competences – reports of heads of enterprises, institutions, organizations located in appropriate area on the matters of environment protection, beatification and etc. Besides, citizens’ gatherings exercise public control over implementation of laws and other acts of legislation as well as their own decisions. They undertake decisions on the use of financial resources of enterprises and organizations located in the appropriate area on contractual basis and for purposes of beautification, gardening and sanitary cleaning; as well as activities directed to preserve surrounding environment.
4. PROJECT ENVIRONMENTAL BASELINE CONDITIONS

4.1 Physical Resources

In geomorphologic relation city of Bukhara is located in southern part of Bukhara oasis within boundaries of ancient cone-removal of Zaravshan River on the surface of above-the-flood-plain terrace III and is assigned to big Bukhara and Khiva depression.

Zaravshan River flows in meridian direction 20 kms to the west from city bounds in the southern part of the depression. The Landscape of the valley is formed basically by quaternary sedimentation.

Area landscape is flat with total inclination of 0,0003-0,0004 to the South-West and partial inclination to the South-East to oasis peripheral with absolute marks – 218-230 meters.

Total flatness of the landscape is broken by separate hills of anthropogenic origin with little waviness. Formation of wavy relief forms in conditions of irrigated agriculture is related to erosion and accumulative processes and accumulations of irrigation sludge precipitations.

Location of the city of Bukhara in the ancient oasis that emerged among deserts, on open plain, bordering with Kyzylkum deserts to the west, and with Karshi and Karnapshul steppes – in the remaining directions, conditions sharp continental and dry climate character.

Area of study is characterized by high solar irradiation, which reaches up to 150 kcal and more. Annual average air temperature is 16,0°C, monthly average temperature of the coldest month - -3,0°C, and the hottest month’s temperature equals to 37,2°C. Absolute maximal figure was observed in July - +46,2°C, and absolute minimum – in January -17,0°C.

Winds of north and north-north-western direction predominate in the city (23,6 and 19,8% accordingly). The most often winds are speeded at 2-3 m/sec. and 4-5 m/sec., their repetition reaches up to 37,6% and 33,1%. Repetition of mild winds (0-1 m/sec.) comprises 11,5%. Mild (gentle) winds cause accumulation of polluting substances around low-set sources of emission. Raised and high speeds of wind cause transferring of impurities to distant locations. Annual average wind speed in the raion – 3,6 m/sec.

Atmosphere condition is considerably affected by the quantity of precipitations, which fulfill the cleaning function. The small quantity of precipitations is characteristic for the city, annual value of which comprises 138 mm in average.

4.2 Water Resources

Surface waters

The city is located in Zaravshan River basin, which origins from a glacier located in the junction of Turkestan and Zaravshan ranges on the territory of Tajikistan. The river’s total length is 781 km. It crosses Bukhara region (oblast) at length of 18.5 km from right-bank side and ends at Kharkur hydro-unit (complex). It is located on Zaravshan river at the border of Bukhara region. The drain of the river totals about 150-300 million m3/year, taking into account water inflows from Amu-Darya (in order to increase capacity of water inflow to Zaravshan river, water is supplied/transferred from Amu-Darya river) that improves quality of water in the river (because quality of waters of Zaravshan river is being worsened in view of collector-drainage waters from irrigated lands and drains from population and industry are transferred to it, while waters of Amu-Darya river are purer than the ones of Zaravshan river, as a result water is diluted and its qualitative indices are improved. This information is well-documented and in this view is presented briefly in the report). Average
perennial water discharge is 165 m$^3$/sec. The Zaravshan River is currently fully regulated by Kattakurgan water reservoir.

The river of 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 Tajikistan, which pollute the river by toxic metals, antimony, mercury. The Report represents environmental problem of water resources in the regions, located in Zaravshan river basin.

In the territory of Uzbekistan the river Zaravshan is affected by the sewage from different industry enterprises of Samarkand, Kattakurgan, Navoi and sewage from farmlands (Project relevant industrial enterprises are listed in Paragraph. 4.7 of the report).

This impact is appeared in the fact that river water mineralization increases from its origins from 305,0 mg/dm$^3$ (0,3 MAC) to outfall of 1364,1 mg/dm$^3$ (1,4 MAC) at average index of watercourse of 658,7 mg/dm$^3$ (0,7 MAC). In comparison to data of the previous year river mineralization has not considerably changed.

River oxygen regime in 2007 was unsatisfactory, dissolved oxygen concentration is at level of 9,90 mgO$_2$/dm$^3$.

In the territory of Uzbekistan the River of Zaravshan inflows with content of organic substances (COD) at level (of 3,32 mgO$_2$/dm$^3$ (See Appendix 1. Quality of Zaravshan river water, where change of water quality by main river stations for several years is provided). By river current organic substances concentration steadily increases to 24,23 mgO$_2$/dm$^3$ at river station lower Navoi. At average their concentration by river comprised 10,20 mgO$_2$/dm$^3$ River water in current lower than Navoi is mostly polluted, maximal concentrations of polluting substances in this river station comprised: by phenols – 0,004 mg/dm$^3$ (4 MAC$^1$), by mineralization – 1616,5 mg/dm$^3$ (1,6 MAC), chrome VI – 1,4 mg/dm$^3$ (1,4 MAC), by copper – 3,5 mg/dm$^3$ (3,5 MAC), by nitrites – 0,124 mg/dm$^3$ (6,2 MAC), by nitrogen ammonium – 0,06 mg/dm$^3$ (0,1 MAC). Occurrences of HCCH and DDT isomers and of metabolites were not observed.

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).

Superficial and underground waters in the lower current of Zaravshan River are characterized by increased mineralization (0.6-2.0 g/l), hardness, phenols, organic chemistry, that is connected with reduction of fresh water in Bukhara region in Zaravshan river. After increase of water usage to irrigation the grounds in the Samarkand, Djizzak and Kashkadarya regions and with increase of dump in the river of collector-drainage waters, the mineralization steadily grows.

Sources of drinking water supply

Water supply of Bukhara city is based on superficial waters of Kuyimazar water basin (Kuyimazar water-intake – 145 thousand m$^3$/day), Djuyzar channel (Zaravshan water-intake – 50 thousand m$^3$/day) and Shahrud channel (Besharyk water-intake). Since 1994, water from Zaravshan deposits of underground waters of the Samarkand region (Damkhoja water-pipe with large bore – 110

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$^1$ 4 MAC, means maximum admissible concentration is exceeded 4 times, maximum recorded pollution of river with phenols, etc. All information is obtained from officially published data of Uzbek hydrometeorology service. Annuals on surface waters quality on the territory of Uzbek hydrometeorology agency activity for 2006-2007, Tashkent, Uzbek hydrometeorology service. During conduction of examination, State Nature Protection Committee verifies all information, presented in EIA, therefore only reliable data is provided.
thousand m3/day) serves Bukhara city. Only quality of Damkhoja water-intake meets the requirements of State standard (GOST) for drinking water without treatment.

Water from water intakes is cleared in sediment bowls and filters and after it is pumped and collected in fresh water reservoirs, where water from Damkhoja water intake also comes. After disinfecting in tanks water is pumped to city’s ring-type water supply system. General capacity of water intakes makes up 300 thousand m3/day, actual production 260 thousand m3/day.

Irrigation watercourses

Shakhrud channel serves as an irrigation source for Bukhara city and it origins from Zaravshshan River. On the coastal strip of the channel by-channel fresh-water lenses are observed that supply Besharyk water-intake.

Besides the irrigation network, collector and drainage network located within city bounds also is developed, water dump from which is effected to city outskirts.

In this chapter the information on water resources, water supply resources, and wastewater collectors is provided, the information on water supply and sewerage is presented below in Paragraphs 4.5 and 4.7. In the city of Bukhara the centralized system of the wastewater collection is present (scope of the population coverage of 50%) with cleaning drains on constructions of full biological clearing in artificial created conditions in aeration tanks. Wastewater discharge after cleaning is effected via a collector of total length of 2 kms to Sakovich collector and further to Dengizkul Lake. The chemical composition of water in Sakovich collector (2008) is presented in Table 4.2.1.

Table 4.2.1. Chemical composition of water in Sakovich collector (2008)

<table>
<thead>
<tr>
<th>Pollution index</th>
<th>Average concentration</th>
<th>MAC for fishery purposed waters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen, mg-O2/l</td>
<td>6,41</td>
<td>4-6</td>
</tr>
<tr>
<td>BOD5, mg-O/l</td>
<td>24,0</td>
<td>3-6</td>
</tr>
<tr>
<td>COD, mg-O/l</td>
<td>19,0</td>
<td></td>
</tr>
<tr>
<td>Nitrogen (ammonium), mg/l</td>
<td>4,3</td>
<td>0,5</td>
</tr>
<tr>
<td>Nitrites, mg/l</td>
<td>0,048</td>
<td>0,02</td>
</tr>
<tr>
<td>Nitrates, mg/l</td>
<td>7,3</td>
<td>9,1</td>
</tr>
<tr>
<td>Iron, mg/l</td>
<td>0,41</td>
<td>0,5</td>
</tr>
<tr>
<td>Chlorides, mg/l</td>
<td>350,0</td>
<td>300,0</td>
</tr>
<tr>
<td>Sulfates, mg/l</td>
<td>410,0</td>
<td>100,0</td>
</tr>
<tr>
<td>Suspended sediments, mg/l</td>
<td>28,0</td>
<td>15,0</td>
</tr>
<tr>
<td>Phosphates, mg/l</td>
<td>0,51</td>
<td></td>
</tr>
<tr>
<td>Mineralization, mg/l</td>
<td>1900,0</td>
<td>1000,0</td>
</tr>
</tbody>
</table>

As it is evident from the table fishery industry purposed water’s MAC in collector by mineralization and suspended sediments indices exceeds 1,9 times, sulfates – 4,1 times, chlorides – 1,17 times, nitrites – 2,4 times, nitrogen ammonium – 8,6 times. Water of such quality flows from the collector into Dengizkul Lake. Maximum admissible concentration (MAC) of pollutants serve as water quality standard in the Republic. Sakovich collector is a waterway for fishery purposes only and not for communal and drinking. It collects drainage, storm waters and drains and after directs them into the lake. In the republic collectors, channels, rivers and water reservoirs are attributed to the category of fishery purposed and therefore appropriate MACs and requirements on discharges from different objects based on those MACs are applied to them.
Ground waters (\textit{GW})

Ground waters are uncovered at depth of 1.0-3.5 meters from surface level. Area with GW occurrence at depth of 1.0 up to 2.0 m comprises about 70\% of the researched area. Within bounds of the remaining area (city’s southern part) water occurs at depth of 2.0 to 5.0 m. At the site of the Old Bukhara and Ark palace, it occurs at depth exceeding 5 m. As a rule, high level of GW is observed by the departments of Uzhydroingeo (Para. 9.3 describes all organizations, conducting government monitoring of environment) in months of March-April with seasonal amplitude variation of 1.0-1.4 m. GW in the city of Bukhara are mildly sa linated. Mineralization of ground waters varies from 644 mg/l up to 5382 mg/l with sulfates predominance (from 200 up to 2614 mg/l) and sodium and potassium (from 107 up to 1037 mg/l). Content of chlorine ions vary from 110-1329 mg/l. The most salinization of water is observed in wells in the raion of Ark palace and Bukharziy madrasah locations. GWs according to their chemical composition are aggressive to concrete based on Portland cement. Information on GW is given for 2007-2008 in Appendix 1.

There are 57 VDW built in the city for purposes of land-improvement of the territory, 17 of them are currently operating (including Kagan). Drainage wells drilled in the territory of the city in order to decrease GW level have not reached a certain effect as they operate irregularly.

Thus, hydro-geological conditions of the city represent a certain problem for deep foundations and metal underground constructions.

Considerable impact to GW and environmental condition of the city is provided by drains coming out from unconnected population, a collector, gathering these drains and polluted drainage waters.

4.3 Land Resources

Whole city territory according to geological and geomorphologic factors is attributed to one raion (I), which represents an ancient cone-removal of Zaravshan River (surface III of above-the-plain terrace).

From the surface up to its depth of 6.0-25.0 m it is formed by quaternary water-saturated clay and sand-gravel sediments, which are covered by heterogeneous and ventilated Neocene soil.

Banked (filled-up) ground is of wide spread. Its volume comprises up to 10-15 m near the raion of Ark citadel (fortress), up to 2.5 m – in the Old city and up to 0.2 m – within bounds of peripheral part of the Old city. Clay soil are water-saturated and with low soil bearing capacity.

Salinity of soils at up to 2.0 m depth varies within 0.16-2.25\% out of total dry soil mass. Content of ion chloride and -sulfate accordingly comprised 0,011-0,097\% and 0,072-1,428\%. Ground is characterized as low saline. The level of aggressiveness varies from low aggressive with regard to concrete of cyclic permeability based on Portland cement up to mid-aggressive with regard to concrete of standard density based on sulfate-resistant cement as well as relates to low aggressive with regard to reinforcement of concrete elements.

Total area of the city of Bukhara comprises 7587 ha, including an irrigated area of 2626 ha. Vegetation including trees, bushes and other plants occupy 640 ha, farmlands and collective gardens – 638 ha, and parks – 23 ha out of total area of the city.

Soil cover is represented by irrigated and meadow-oasis alluvial soil of desert zone, low-saline. Soils are considerably changed by irrigated agriculture. Humus content in plough-layer comprised 0.8-1.4\%. Soils are desalinated by systemic flushing. Soil pollution by chloro-organic pesticides and
heavy metals does not exceed background and maximum admissible concentrations. Maximum admissible concentration (MAC) for grounds as well as for waters and air. I.e. MAC is determined for each type of environment. MAC values comprise entire books, such as SanPIN № 0057-96 «Assessment of scales of pollution of soils for various types of land use» T., 1996; - SanPIN № 0055-96 «Maximum admissible concentrations (MAC) and approximate-admissible concentrations of exogenous dangerous substances in soils» T., 1996. The level of soil pollution is admissible.

4.4. Biological Resources

According to the requirements of State Department of Ecological Expertise for EIA, it is necessary to describe current condition of environment at project territory by all spheres, determine existing environmental problems and then assess which measures may affect the environment. In this view chapter 4 provides information on environment condition, including biological resources. Greeneries (vegetation) will be affected during construction of new sewerage networks. The main parts of greenery are situated in the northern and western parts of the city: park “Komsomol Lake” - in the North with an area of 20 hectares and city park in the West with area of about 15 hectares. The other greenery is scattered over different parts of the region in the view of small squares and separate green plots. The largest one is mountain mass near the building of regional Khokimiyat, square near Ark fortress and square near Lyabi Hauz.

Artificial wood plantations, flower gardens and lawns, weed classifications of mesophytic and halosere species are combined in vegetation cover of the city and outskirts. Haloseres such as reed mace, reed, and sparse bushes of tamarisk are met along bank of collectors.

Absence of green areas in the southern part of the city is prettified by planting of greenery along some of the main streets. Main streets of the city are planted with new kinds of trees such as Japanese pagoda-tree, chestnuts, pines and junipers. Old trees are also preserved in the city like eastern plane, elm-tree, willow, ash, mulberry, apricot, apple tree, plum tree, and vine. Along with fruit trees vegetables are also grown, combined with berry plants and bushes at the farmlands. Farmlands will interfere with the proposed works to be financed by the Project, as connection of drains from private houses to sewerage system will result in reduction of wastes disposal to their plots as well as decrease in pollution of grounds and grown vegetables.

Single mulberries are grown between plots of the fields in outskirts of the city. The condition of plantations of trees and bushes is satisfactory («Satisfactory», means they are green, not dead, roots and leafage are not damaged. Further in the text below sentence describes the meaning and reason of considering greenery condition as “unsatisfactory”) due to regular watering and additional fertilizing. Due to moisture and lack of care, plants begin to suffer from negative impact of dusty and dry air, soil salinity, undergo to diseases, marginal and inter-rib chlorotic spots appear on leaves.

There are settlements with private farms within the boundaries of the city. Fauna includes those species which live in close vicinity with human being. Domestic animals, insects, birds, rodents are related to them. Pollution grounds and waters with faecal wastes caused by leakages, accidents and not-canalized population leads to infection of small animals, rodents and worsening of sanitary epidemic condition in the city. Solution of this problem will be covered by the Project.

One can meet holes of small rodents such as ground squirrel, meadow mice in city outskirts. Ground rats, mice and others settle in melon plantations, gardens. Toads, frogs settle near aryks.

Laughing dove, tree sparrow, common STARLING, my-lady's-belt, rook, carrion crow, and magpie are often met among birds. Ways of some birds’ migration were changed during Iraq war; particularly rose-colored starlings migrate via Bukhara.
4.5. Social resources.

Impact of environmental factors of different nature and character (social, economic, biological, natural and climatic, chemical, physical and others) leads to negative effects development in level of population health.

Government of the Republic of Uzbekistan and local authorities in Bukhara assign great importance to matters of improvement of environmental situation and healthcare, which do not meet requirements of sewerage system and sewage water treatment in that historical and cultural centre, situated on the Great Silk Road.

Population of Bukhara comprises 300 000 inhabitants where 133300 are men and 130200 are women. Number of families is determined by 56000 persons in the city. 1554 people are born and 662 die annually. Population size increase, growth of house building makes necessary in making of new communication linkages and rehabilitation of already existing ones.

There are 11 hotels of Uzbekturism and 45 private hotels in the city.

In 2007 gross income to city budget comprised 7,3 billion UZS, 7,2 billion were spent including education sector – 62,9%, healthcare – 15,8%, culture – 0,8%.

At present time population coverage of Bukhara city by centralized water supply system composes 98%, centralized sewerage – 50%. Centralized water supply system has been operated since 1966. There are such places where sewer pipes go out surface leading to insanitation, and stimulating diseases distribution. However most of the inhabitants of new districts have sewerage system. Most part of households which do not have sewerage system use cesspools and/or discharge liquid wastes directly into the street or yard.

The leakage of transferred waste water through damaged plot is the reason of ground pollution. Leakage increases ground’s level of bedding; leads to territory underflooding, increase soil salinity, oppression of plants, and causes threat to population’s health, using water from not too deep nearby wells. These factors lead to accumulation of pollution and fecal pathogenic organisms in the open irrigation and drain canals which in the final analysis worsen quality of surface waters and invoke diseases connected with water resources usage for irrigated needs. The paragraph describes current condition in social sector, which is one of the main factors requiring implementation of this Project.

Most of the households express their dissatisfaction about Water treatment plants activity. Their dissatisfaction is stipulated by the following reasons: low efficiency of Water treatment plants in providing with repair works, passive reactions for requests for repair works implementation, and also “pressure” from part of service providers on purpose for unofficial payments receiving on repair works implementation which should be done free of charge. Here, current situation and population attitude to the work of Vodokanal is shown.

Following State standard 950:2000 «Drinking water», sanitary and epidemiological service of the Republic implements constant quality control of drinking water delivered by municipal water supply as well as departmental. According to Ministry of Public Health for the last years in Bukhara city drinking water quality became worth on microbiological indicators and fluctuates from 13,57% in 2000 to 15,69% in 2004, in region- from 5,6% in 1999 to 9,9% in 2006. Data on quality of drinking water in water supply system and foodstuff characterizes condition of social sector and not water and land resources. In the National Report of State Nature Protection Committee of the Republic of Uzbekistan “On condition of environment and use of natural resources in the Republic of Uzbekistan” all the above-mentioned information is considered as Social aspects.
Specific weight of drinking water samples of municipal water supply which does not correspond to hygienic demands on chemical indicators in Bukhara region made 43,3 % (2006) and 50,7% (1997). Main deviations from national standard are noted on level of mineralization and general rigidity (chemical indicators).

By the hour drinking water supply assists its quality changing on microbiological indicators. Besides, cases of damages at water supply networks influence the quality.

Supervision on diseases of food nature and control of foodstuffs pollution is one of main activities of bodies of sanitary epidemiological service on nutrition hygiene.

Deviation from hygienic standards was noted on organoleptic indicators (acidity, transparency, deposition) 10%, and also on content of toxic elements (lead, cadmium, zinc)- 0,2%, on energetic value of foodstuffs -34%, iodine availability in dietary salt- 30%, on organic admixtures in beverage foods-10%, on nitrate availability in crop production- 3,0%, other indicators- 12,8%.

In region general death incidence stabilize and composes accordingly 4,5 case for 1000 persons/year, infant mortality reduced from 19(2000) to 14 (2004) case for 1000 person/year. But there is tendency of population morbidity increase from 463,7 to 613,7 appeals for 1000 persons/year.

4.6. Physical Cultural Heritage

City of Bukhara is one of the ancient cities of the Republic of Uzbekistan. In 1996 the city celebrated its 2500 anniversary. There are 997 historical and architectural and archeological monuments persevered in the city till present. The most ancient monuments are: Ark fortress –V-VII A.D., Kalon Minaret – XII A.D., Sayfitdin Bukharzi Mausoleum - XIII A.D., Buyan Kalikhon Mausoleum – XIV A.D., trade domes – XVI, water reservoirs – XVI, bathhouses – XV-XVI A.D. and others.

Restoration works on recovering and preserving of ancient monuments are conducted on a regular basis. Existence of monuments considerably predetermined visiting of the city of Bukhara by multiple tourists.

It is necessary to note that historical center lacks sewerage network and ground waters observation wells network is not sufficient. Because of high rising of ground water level basements get saturated, salts from ground are rising and having combined with oxygen crystallize causing deterioration of historical monuments basements. In certain parts of the city, where Ark Fortress and Bukhorziy Madrasah are located, mineralization of ground waters increase up to 4282-5382 mg/l with chlorine and sulphate ions predominance up to 1329 mg/l and 2614 mg/l accordingly. By the reason of high ground water level in certain parts of the city and their aggressiveness in places of hyper mineralization, it is necessary to build drainage, hydroisolate below-grade parts of buildings and structures and protect concrete from attack.

Only Buyan Kalikhon and Sayfitdin Bukharzi Mausoleums fall into the zone of project activities.

4.7. Identification of Key Environmental Problems

Main problems on the territory of Bukhara city are the following:

- High level of ground waters at certain areas;
- Insufficient condition of drainage network leading to raise of ground water level;
- Difficulties with population cover with centralized sewerage network;
- Impoundment of the territory;
- Pollution of soils and grounds, ground waters because of unorganized discharge of waste waters without treatment;
- High seismicity and subsidence of the city territory.

High level of ground waters (1.0-2.0 m) is observed in the most part of old Bukhara, except south part of the city. Irrigation of greenery, farmlands, irrigated arable lands having broken-down antifiltration screens at part of irrigation network of capital stations equipped with automatic devices for control of water supply at flow diversion and ineffective operation of drainage (11 vertical wells in Bukhara city and 6 ones in Kagan city are operating) result in raise of ground water level, impoundment of certain parts of the urban territory (during the period of maximum raise of ground water).

Lack of urban sewerage network on the most part of the territory, break-down of domestic treatment facilities at the enterprises or their lack, inefficient work of urban treatment facilities lead to pollution of ground waters and soil with nitrogenous compounds, oil products, suspensions, organic compounds.

Active pollutants of ground water and soil are communal objects, schools, kindergartens, medical care institutions as well as enterprises, particularly, poultry farms, dairy farms discharging wastes to landscape area without treatment. Waste waters contain mineral insoluble impurity, wool, forage remains, blood, ammonia nitrogen, phosphates, organic compounds (proteins, fats, carbohydrates).

In the territory of the city (mainly, in south part) where ground water level is more than 3-5 m, subsidence at extra load take place. This is contributed by leakages of water and sewerage pipeline networks, precipitations leading to humidification of grounds, subsidence which in its turn cause deformation of buildings.

Among modern geodynamic processes seismicity, impoundment, corrosion and anthropogenic phenomena take place in the city.

Corrected seismicity rate of Bukhara territory is 8 points. Anthropogenic process appearance is evinced in accumulation of filled grounds and is observed everywhere. The biggest thickness of these grounds is observed in the territory of Ark Fortress and is 10-15 m, old part of Bukhara city and the adjacent territory observe 2-5 m and 0-2 m accordingly.

At present only about 50% of Bukhara (including neighboring town of Kagan), is connected to the central sewer system.

**Sewerage system** represents a separate system with total sewer lines comprising 189,1 km (172,7 km in Bukhara + 16,4 km in Kagan). Sewerage collectors are mostly made of reinforced concrete and some of pipes of smaller diameters – usually asbestos concrete and cast iron. Diameters of sewer pipes vary from 200 up to 400 millimeters for secondary network, and as for collectors – 600 up to 1 500 millimeters. In some places wastewater is transported by gravity, although area landscape requires regular pumping over of wastewater.

There are a total of 16 wastewater pumping stations (WWPSs) in the sewer system. Out of these 2 are ‘Main WWPSs’. Operation is completely manual. The feature of all WWPSs is high level of energy consumption which is caused by the use of low efficient and/or old pumps. The majority of objects of the sewer system was constructed in 60-s and has been operated during 30-40 years. As a result of above-mentioned the system is much deteriorated. Often clogging and break downs in the sewer system occur. (Drawing 4.7.1.)
The ground-water table is generally about 1-2 m below ground surface. Since collectors are up to 8 m deep, there is an unknown extent of wastewater losses into the groundwater and/or groundwater infiltration into the sewers. Besides negative impact to the environment and sanitary and hygienic condition it leads to considerable dilution of the wastewater and impairs treatment results.


All collected wastewater is gathered at the only city wastewater treatment plants (WWTP) located in Bukhara. Construction of the municipal WWTP started in 1966 and after that it was expanded several times. Latest considerable capital investments were made approximately 25 years ago.

Technology of treating wastewater is based on traditional concept of the use of activated sludge, featuring screen, grit chamber, primary sedimentation, aeration tanks and final sedimentation. The effluent is polished by 2 ponds, chlorinated and then discharged. Sludge is stored at drying beds. (Drawing 4.7.2)
In 2007 average flow arriving at Bukhara WWTP was 43,300 m³/d, i.e. 290 lcd; average pollution load in influent wastewater in 2007 comprised 5,500 kg BOD₅/y, i.e. 37 g BOD₅/cap/d. Nominal capacity of WWTP – 100,000 m³/d. Besides, information on design characteristics of WTTP such as pollution concentration in influent wastewater, designed working temperature and etc. is unavailable (except data on wastewater discharge). As it is evidenced by preliminary analysis, volume of available capacities is enough to provide cleaning at present as well as in mid-term perspective taking into account forecast wastewater discharge rates and pollution load.

Actual efficiency of treatment facilities by ingredients is represented in Table 4.7.3.

<table>
<thead>
<tr>
<th>Name and structure of the treatment facilities and the methods of the treatment</th>
<th>Full-capacity discharge, actual, m³/day</th>
<th>Treatment efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sewage Treatment Facilities (STF) in settlement «Kozy-Said» Bukhara rayon, Bukhara region. Treatment by bioassay technique</td>
<td>43 thousands</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Actual concentration, mg/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Suspension</td>
<td>70</td>
</tr>
<tr>
<td>2. BOD</td>
<td>40,8</td>
</tr>
<tr>
<td>3. COD</td>
<td>45</td>
</tr>
<tr>
<td>4. Solid</td>
<td>1800</td>
</tr>
<tr>
<td>5. Chlorides</td>
<td>550</td>
</tr>
<tr>
<td>6. Sulphate</td>
<td>560</td>
</tr>
<tr>
<td>7. Phosphate</td>
<td>0,85</td>
</tr>
<tr>
<td>8. Ammonium nitrogen</td>
<td>7,3</td>
</tr>
<tr>
<td>9. Nitrogen nitrite</td>
<td>0,065</td>
</tr>
<tr>
<td>10. Nitrogen nitrate</td>
<td>11,1</td>
</tr>
</tbody>
</table>

Both structures and electro-mechanical equipment at WTTP of Bukhara are in very bad physical condition and are low efficient. The basic problem is represented by the existing aeration system at biological treatment stage, which needs 2-3 times more energy as if it worked as much time as it was possible, than is consumed by effectively operated European WWTPs that are of equal capacity and for treating wastewater with similar quality.

Energy supply to WTTP is variable and available electric energy is not sufficient for proper treatment of wastewater. As a result, treated wastewater does not reach established norms of maximum admissible level of discharge (MAL). It is required to increase the effectiveness of treatment process, especially of aeration system. Some equipment such as influent and effluent wastewater samplers, flow measurers, screens and grit chambers as well as laboratory building need urgent rehabilitation or replacement. Reconstruction of the remaining equipment and reorganization of existing technological process is planned for the second stage of Project implementation. In the nearest future there is no need to build new capacities/sedimentation tanks.
Table 4.7.4 Influent and effluent data, Bukhara WWTP

<table>
<thead>
<tr>
<th></th>
<th>BOD5</th>
<th>COD</th>
<th>NH4-N</th>
<th>NO3-N</th>
<th>TN</th>
<th>PO4-P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CONCENTRATION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Influent [mg/l]</td>
<td>126,5</td>
<td>183</td>
<td>10,7</td>
<td>---</td>
<td>28,7</td>
<td>3,0</td>
</tr>
<tr>
<td>Effluent [mg/l]</td>
<td>26</td>
<td>43</td>
<td>5,3</td>
<td>---</td>
<td>16,5</td>
<td>2,5</td>
</tr>
<tr>
<td>Discharge criteria [mg/l]</td>
<td>20</td>
<td>---</td>
<td>2,5</td>
<td>10,1</td>
<td>---</td>
<td>0,7</td>
</tr>
<tr>
<td><strong>POLLUTION LOAD</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Influent load [kg/d]</td>
<td>5,480</td>
<td>7,906</td>
<td>464</td>
<td>---</td>
<td>1,242</td>
<td>130</td>
</tr>
<tr>
<td>Population Equivalents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[PE60]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population Equivalents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[PE120]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population connected to sewer [cap.]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capita specific load [g/cap/d]</td>
<td>37</td>
<td>53</td>
<td>3,1</td>
<td>---</td>
<td>8,3</td>
<td>0,9</td>
</tr>
<tr>
<td>Typical European figures * [g/cap/d]</td>
<td>60</td>
<td>120</td>
<td>---</td>
<td>---</td>
<td>11,0</td>
<td>1,8</td>
</tr>
</tbody>
</table>

* … [4]

The above influent data leads to the following conclusions:

- **Low influent concentrations.** That points towards high water consumption and problems with infiltration of ground-water.
- **Easily biodegradable wastewater:** COD / BOD₅ = ca. 1.5.
- **Ratios between different parameters:** BOD₅ / TN / PO₄-P = 100 / 23 / 2.3. This matches what is typically found in wastewater: BOD₅ / TN / TP = 100 / 18 / 3 in Germany [4] and 100 / 25 / 4 as a European average. (Note: TN was not metered directly in Bukhara, but rather estimated on the basis of available N data.)
- **Influent load:** The influent BOD₅ load equals to 37 g BOD₅/cap/d. In Europe this figure is typically 60 g BOD₅/cap/d.

Most part of such drains, finally, leak into the ground and/or ground waters.

Citizens of Bukhara city, not connected to sewerage system (i.e. about 150 000 people) use cesspools and septic tanks of doubtful standard in their plots. Cesspools are mainly built without filter screen which enables filtration of waste waters into the ground and ground waters polluting them and threatening population health. Most part of these drains/wastes either flows into the sewerage system or are reused as fertilizers or simply is disposed and purred to area landscape. First option leads to operational problems in sewerage system (clogs, sediments) and sewerage treatment facilities (peak overload), and two last causes environmental and sanitary hygienic problems. In order to change this situation, Bukhara operation-production department “Suvokova” need to extent existing sewerage system, reduce number of “facilities” at plots and connect additional number of citizens to sewerage system.

As an emergency measure it is necessary to organize receiving of liquid communal wastes, disposed in special transport from population to special tanks, which should be located in the territory of sewerage treatment facilities in front of inleak chamber. Then received wastes should be sent for treatment in doses. Such practice took place in BVK last years, it is necessary just to reestablish the contacts with municipal bodies and solve out organizational issues.

Thus, analysis of current condition of environment showed that many problems of the city are related to its canalization and may be eliminated and reduced by reconstruction of sewerage system.
5. ENVIRONMENTAL ANALYSIS OF PROJECT INVESTMENTS

5.1. Introduction

As World Bank Operation Guideline 4.01 – *Environmental Assessment* does not provide prescribed format or structure for assessment of actual impact; such structure was developed specifically for this Project taking into consideration national requirements to EIA. Assessment is made taking into account different perspectives:

- Impact by type of measures (physical options) – Section 5.3
- Impact related to project location – Section 5.4
- Impact during project implementation and mitigation measures – Section 5.5
- Long-term impact and mitigation measures – Section 5.6

5.2. Measures and work structure

Project stipulates execution of the following works:

Component “Reconstruction/ expansion of sewerage networks, pumping stations and WWTPs”.

In the sewerage network the Project will provide with repair-and-renewal operations of collectors with total length 40,7 kms, which are in unsatisfactory condition (sewer pipes replacement) within sections presented in table 5.1 and Drawing 5.1.

In the sewerage networks which are partly silted and damaged or have silted observation wells, pipes reconstruction and their flushing is suggested.

<table>
<thead>
<tr>
<th>No</th>
<th>Activity title</th>
<th>Total quantity (km)</th>
<th>Project Phase-I (km)</th>
<th>Project Phase-II (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Drift collector from PS-2 to Shark-1 micro-district, PS-6; d=800 mm</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Drift collector from crossing between Khalklar Dustligi str. and Piridastgir str. to Shark-2 micro-district (to B.Nakshband str., house No 6/1); d=800 mm</td>
<td>3,1</td>
<td>3,1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Collector via bypass road from &quot;Udurgi&quot; settlement to crossing with Khalklar Dustligi str.; d=1000 mm</td>
<td>3,2</td>
<td>3,2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Collector along Khalklar Dustligi str. from crossing between Alpomish str. and Piridastgir str. up to bypass road; d=800 mm</td>
<td>2,3</td>
<td>2,3</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Collector along Mustakillik str. from crossing with Piridastgir str. up to bypass road; d=800 mm</td>
<td>2,4</td>
<td>2,4</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Collector along Gazli highway from PS-6 to crossing with A.Shneyder str.; d=1000 mm (Eastern collector)</td>
<td>3,1</td>
<td>3,1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Replacement of dilapidated collector from crossing between Navoi ave. and K.Murtazaev ave. up to oblast Khokimiyat building; d=800 mm</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Reconstruction of broken down section of country collector; d=1000 mm</td>
<td>2,5</td>
<td>2,5</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>from Alpomish str. along T.Faroqiy str. up dwelling house No.31 (Southern collector); d=1000 mm</td>
<td>0,6</td>
<td>0,6</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>From crossing between K.Murtazaeva str. and Mustakillik str. up to Navoi ave.; d=800 mm</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Activity title</td>
<td>Total quantity (km)</td>
<td>Project Phase-I (km)</td>
<td>Project Phase-II (km)</td>
</tr>
<tr>
<td>----</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------</td>
<td>----------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>11</td>
<td>Replacement of a head line form PS-2 to K.Murtazaeva ave.; d=700 mm</td>
<td>1,2</td>
<td>1,2</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Replacement of dilapidated head line of PS-3, Mustakillik str., Raion clinic-1; d=300 mm</td>
<td>0,8</td>
<td>0,8</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Replacement of dilapidated head line of PS-4 (K.Murtazaeva ave., Raion clinic-2, kindergarten-13); d=300 mm</td>
<td>0,4</td>
<td>0,4</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Replacement of dilapidated head line PS-Infectious diseases hospital; d=300 mm</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Replacement of dilapidated sewer line; d=600 mm, along Yangiobod str. from Bus-station, along Afrosiyob str. up to the bridge</td>
<td>1,8</td>
<td>1,8</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>From PS-7 (boarding school-24), up to Eastern collector; d=400 mm</td>
<td>0,6</td>
<td>0,6</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>From &quot;Vodnik&quot; settlement up to main collector of Shark-1; d=600 mm</td>
<td>0,7</td>
<td>0,7</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>From Buyirobofon str. via Buzovskaya str. and Afrosiyob str. up to M.Karimov str.; d=400 mm</td>
<td>0,6</td>
<td>0,6</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Replacement of dilapidated drifting collector from Mustakillik str. along S.Ayni str. up to Khamza str.; d=600 mm</td>
<td>0,3</td>
<td>0,3</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Reconstruction of drifting collector along I.Muminova str. from oblast Khokimiyat building up to Gorvoenkomat (military enlistment office); d=1000 mm</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Reconstruction of sewer line along Khamza str.; d=600 mm</td>
<td>0,8</td>
<td>0,8</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>From dwelling house-1/5 along Piridastgir str. up to sewer collector along Alpomish str.; d=600 mm</td>
<td>0,6</td>
<td>0,6</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>From dwelling house-15/1 along Mustakillik str. via City bathhouse-6 up to sewer collector along Melkobinatskaya str.; d=600 mm</td>
<td>1,1</td>
<td>1,1</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>From dwelling house-29 Shark-1, up to PS-6; d=400 mm</td>
<td>0,6</td>
<td>0,6</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Replacement of dilapidated head collector d=600 mm, from WWPS located in &quot;Beklar&quot; settlement of Kagan up to &quot;Kaftarkhona&quot; settlement</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Replacement of drifting collector d=1000 mm, from B.Zokirova str. of Kagan up to WWPS located on territory of “Beklar” settlement</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total by reconstruction:</strong></td>
<td><strong>40,7</strong></td>
<td><strong>29,7</strong></td>
<td><strong>11</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Construction of networks (development)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Completion of construction works of &quot;Jeleznodorozhnyi&quot; collector up to Main WWPS;2 x d=1000 mm</td>
<td>5,6</td>
<td>2,8</td>
<td>2,8</td>
</tr>
<tr>
<td>28</td>
<td>Crossing between Gijduvan and Vabkent str. Up to crossing between Gijduvan str. And Gazli highway (ring of oblast State auto inspection); d=600 mm</td>
<td>1,6</td>
<td>1,6</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>From crossing between Usto Shirin str. with Mirdustim str. up to north-western collector; d=600 mm</td>
<td>1,2</td>
<td>1,2</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>From J.Ikromi str. (from &quot;Siyavush&quot; hotel) up to Khamza str.; d=400 mm</td>
<td>0,6</td>
<td>0,6</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>From north-western collector up to “Chorbakhos” dwelling block; d=400 - 600 mm</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>From Eastern collector Shark-1 along Shirbuddin str. up to the building of the Committee on nature protection; d=500 mm</td>
<td>1,3</td>
<td>1,3</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>From B.Nakshband str. along A.Nabiev str. up to turn to Gulchorbog str.; d=400 mm</td>
<td>1,8</td>
<td>1,8</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>From north-western collector (Knitting factory) up to crossing between Bakht str. and bypass road (along S.Jura str. and O.Hojaev str.); d=500 mm</td>
<td>1,8</td>
<td>1,8</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Connection of houses on territory of makhallas No 17, 5 ; d=400 - 600 mm</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Connection of “Afshor Makhalla” dwelling block to sewerage collector along Namozgokh str.; d=400 - 600 mm</td>
<td>3,8</td>
<td>3,8</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Activity title</td>
<td>Total quantity (km)</td>
<td>Project Phase-I (km)</td>
<td>Project Phase-II (km)</td>
</tr>
<tr>
<td>----</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------</td>
<td>--------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>37</td>
<td>Construction of sewer lines for connection of dwelling blocks to trunk sewer collectors; d=300-400mm</td>
<td>36</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Construction of collector along Boburshokh str. up to M.Tarobiy street of Kagan; d=700 mm</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Construction of drifting collector, d=800 mm, from Zirabod str. up to WWPS located on the territory of “Beklar” settlement of town of Kagan</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Construction of drifting collector from &quot;Oybek&quot; up to Dustlik str. of Kagan; d=600 mm</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Construction of head line from designed PS located on Vatanparvar str. of Kagan town up to PS-Beklar, d=400 mm and of a head line of PS of healthcare objects of Bukhara</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total by construction works:</strong></td>
<td>75,7</td>
<td>2,8</td>
<td>72,9</td>
</tr>
<tr>
<td></td>
<td><strong>Total by sewer networks:</strong></td>
<td>116,4</td>
<td>32,5</td>
<td>83,9</td>
</tr>
<tr>
<td>42</td>
<td>PS-1, Chulpon str., Regional archive building</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>PS-2, Piridastrig str., Main Dept. of Internal Affairs, college of tourism</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>PS-3, Mustakillik str., Raion clinic-1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>PS-4, K.Murtazaeva str., Raion clinic -2, kindergarten-13</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>PS-5, Afrosiyob str. (K.Marx str.)</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>PS-6, Shark-1, dw.house-23 (Green drugstore)</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>PS-7, Gazli highway (boarding school-24)</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>PS-8, Ikbol str., Khoja Ismat cemetery</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>PS-9, A.Nabiev str., Cardiology hospital</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>PS for healthcare facilities of Bukhara city</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>52</td>
<td>Kagan, &quot;Beklar&quot; settlement</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total by reconstruction of PS:</strong></td>
<td>14</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>53</td>
<td>Influent and effluent wastewater samplers</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>54</td>
<td>Flow measurers</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>55</td>
<td>Fine screens(mesh)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>56</td>
<td>Grit catcher (sedimentation tanks)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>57</td>
<td>Modern (biological treatment) protection technology</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>58</td>
<td>Reducing energy consumption of blower pump station</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>59</td>
<td>Reducing energy consumption of return sludge pump</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>60</td>
<td>Reconstruction of rotating mechanisms of sedimentation tanks I and II (scrapers, gutters, current receiver) and of branch outer duct</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>61</td>
<td>Improvement of sludge dehydration</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>62</td>
<td>Rehabilitation of existing civil structures and equipment</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>63</td>
<td>Reconstruction of pumping station at WWTP</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>64</td>
<td>Rehabilitation of fences and repair of inside-area roads</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><strong>Total by WWTP reconstruction</strong></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td><strong>PS CONSTRUCTION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>PS, raion of medical settlement</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>PS, Kagan, Vatanparvar str. (between city hospital and cantonment)</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Repair-and-renewal operations are expected to be provided in 14 pumping stations, which are in emergency state. Renewal works on pumping stations basically include total replacement of pumping units and their installation, electric motor repair, package transformer substations replacement, control rooms and power cables, concrete frames repair. While carrying out these works metal rejects will be formed. Metal rejects have to be gathered in a separate box and are subject to delivery to appropriate posts of recyclable materials.

For project solutions implementation on expansion/ construction of sewerage collectors the following operations will be performed:

- seizure;
- embankment and reverse seizure;
- steel erection and processing;
- sewer pipe installation.

It will remove problems at most intensive plots and will lead to environment and population health improvement.

Proposed works at WWTP in the city of Bukhara are directed to the most vital needs:

- It is anticipated to install 2 new automatic samplers, one at the entrance and another at the exit of WWTP of Bukhara city, as data on quantity of discharged waste water is important.

- Installation of new gratings with small crevice is provided by the project. Gratings have two main purposes: (1) to preserve equipment, located behind them from high wear, (2) not to allow accumulating of materials that are subjected to sorting in the silt. At present none of these tasks is done, as already existing gratings remove only little quantity of garbage.

- New efficient grit chambers will be provided by the project. At present time there are two types of grit chambers: «new» grit chambers, which are not functioning any more and «old» grit chambers, which are operating now. Neither those ones, nor others are modern and allow efficient removing sand and grease.

- It is planned to reconstruct laboratory which is very important for monitoring activity implementation in WWTP.

- Setting up of new aeration system. After installation of new aeration system (new air blowers + new aerators) electric energy consumption for aeration can be reduced to approximately 20 kWh/PE60/year and at the same time improve significantly quality of treatment. For new aeration system it is planned to install: (1) new small air blowers with frequency converter; (2) new fine-dispersed aerators in aerotanks; (3) reconstruct air blowers in such a way that each air blower is connected separately with one of existing 4 aerotanks in order to simplify automation (i.e. total 4 air blowers + 1 reserve + 4 air ducts); (4) detectors/probes O2- and NH4- operating in real time mode in the aerotanks; (5) automation management system.
- Change of existing low efficient pumps for pumping of return sludge to more efficient ones will allow, by conservative estimations, economize approximately 30% of electrical energy. As current energy consumption is artificially reduced because of long-term energy supply failures, even after taking measures on increase of energy efficiency it is supposed that energy consumption by WWTP will increase (assuming electric energy will be supplied without failures in the future).

**Drawing 5.1. Bukhara, wastewater system layout and BVK rehabilitation strategy**

Component “Development of institutional capacity of Bukhara Vodokanal (BVK)”

Potential of BVK is limited due to lack of equipment and modern know-how. The project will include equipment procurement specially intended for improvement of further technical servicing of reconstructed sewerage system. First of all, it means prevention of operational problems and increase of life-span period of sewerage system. Both will assist changing of population’s attitude to sewerage service for the better. Modern cesspool trucks, equipment for flushing and sewerage pipes cleaning, patching excavator, modern workshop and equipment for management will be procured. All these measures will allow reducing negative impact of sewerage on environment.
Component “Increase of public awareness”

This component will include development of informational strategy and capacity to carry out mass media campaigns as well as programs on communities and civil society preparation. Proposed measures will include wide range of components, beginning from booklets, posters and campaigns in local schools to information dissemination on radio and television.

5.3 Impacts by Intervention Type (physical options)

Analysis of technical conditions of treatment facilities, pumping stations and sewerage network within the project area allowed making the following conclusions:

- Technical condition of sewerage network provides with the necessary diversion of flows from population and industrial enterprises; the network is in unsatisfactory condition, and needs in repair;
- Reconstruction of pumping stations for regular transmission of flows to treatment facilities.
- Rehabilitation of work efficiency of treatment facilities, their modernization, replacement of parts of electro-mechanical equipment, etc.

Analysis of impacts by types of works and included to the Project is presented in Table 5.3.1.

<table>
<thead>
<tr>
<th>Table 5.3.1 Summary table on Project components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needs in the wastewater sector</td>
</tr>
<tr>
<td>---------------------------------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>I. INVESTMENT COMPONENT</td>
</tr>
<tr>
<td>1 Rehabilitation of existing sewers</td>
</tr>
<tr>
<td>2 Rehabilitation of WWTPs</td>
</tr>
<tr>
<td>3 Expansion of sewer network</td>
</tr>
<tr>
<td>4 Influent and effluent samplers</td>
</tr>
<tr>
<td>5 Flow measurers</td>
</tr>
<tr>
<td>6 Fine screens</td>
</tr>
<tr>
<td>7 Grit chambers</td>
</tr>
<tr>
<td>9 Reduction of blower energy</td>
</tr>
<tr>
<td>10 Energy reduction return sludge pump</td>
</tr>
<tr>
<td>12 Reconstruction of existing buildings and structures</td>
</tr>
<tr>
<td>13 Strengthening mater.&amp;technical basis of BVK</td>
</tr>
<tr>
<td>II – INSTITUTIONAL DEVELOPMENT</td>
</tr>
<tr>
<td>14 Public awareness</td>
</tr>
</tbody>
</table>
As Table 5.3.1 shows, all anticipated measures, aimed at improvement of sewerage infrastructure, will lead to improved diversion of waste waters, eliminate seepage, as a result it will lead to positive impact on environment and population healthcare, as it will eliminate untreated wastewater infiltration from sewer pipes into ground waters. The important thing is that having prevented dilution of untreated wastewater in sewer pipes with ground waters, which infiltrate into sewer networks, it is possible to improve results of wastewater treatment. Expansion of sewer network will allow increasing a number of connections of population to the sewerage network and that will lead to reducing of unorganized wastewater discharge onto environment and decreasing adverse impacts on soils and GW. The same result is expected from rehabilitation of wastewater treatment plants and reducing of polluting substances discharge into Sakovich collector and further to Dengizkul lake located in the south of Bukhara oblast.

Obtaining of reliable data on waste waters discharge will allow conducting assessment of pollutant load, physical condition of both sewerage network and WWTP equipment. Comparison of data on waste waters discharge with the one on water supply furthers creation of water balance, revealing of ground waters infiltration into sewerage system and vice versa as well as infiltration of storm sewage. Established account of waste waters will allow reliable designing of all stages of waste waters treatment process.

**Table 5.3.2. Preliminary assessment of environmental impact by types of measures**

<table>
<thead>
<tr>
<th>Rehabilitation or new construction</th>
<th>Negative impact</th>
<th>During Project implementation</th>
<th>Positive environmental impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Repair, rehabilitation and construction of sewerage networks (distribution centers and pipelines)</td>
<td>• Pollution of ground and water (surface or ground) by sediments after water cleaning at treatment facilities, pipes and distribution centers. • Pollution of ground waters by surface drain from construction sites. • Pollution of ground and water by building refuses • Leakages of fuel and oils • Pollution of air by dust and exhausts from operating machinery. • Damaging of trees and greens. Random finds of cultural value.</td>
<td>• Temporary and permanent damages because of construction works Temporarily and permanent damages because of construction works; construction/rehabilitation of access roads may be needed</td>
<td>• Improvement of ground and water quality, sanitary epidemic conditions • Reduction of quantity of non-sewered waste waters from population • Improvement of quality of treated waste water which will lead to reduction of sickness rate of the diseases transferred by water • Improvement of quality of ground waters through elimination of losses at transportation of waste waters to treatment facilities</td>
</tr>
</tbody>
</table>

Impact of measures on environment will occur mainly from this component; this impact will be visible and tangible during construction. As Table 5.3.2 shows impact consequences will be mainly positive and negative consequences will be local, temporary and reversible.
Implementation of project decision on the Component Reconstruction/extension of sewerage networks, pumping stations and WWTP will lead to improvement of quality of diverted waste waters, which affects beneficially environment and public health.

**Impact of Component “Improvement of Bukhara Vodokanal (BVK) capacity”**

*During project operation stage*, executed measures will allow further operation and maintenance of reconstructed sewerage system and treatment facilities, increase of reliability of regular diversion of drains from population, industrial enterprises and organizations, its standard treatment at treatment facilities which will promote improvement of ground and surface waters quality. In general, project area will observe improvement of environmental condition as a result of improvement of BVK capacity, prevention of operation problems as well as increase of lifetime of sewerage system. All these measures will allow reduction of negative impact of sewage on environment.

**5.4 Impacts by Project Location**

Almost all project activities will be implemented within the city, around existing sewerage infrastructure and at treatment facilities (plants). A combination of activities (physical options) will be implemented across the most of project area.

Across the whole territory of the Project the positive impact will be basically represented by improvement of wastewater diversion, elimination of seepage and that will lead to decrease of problems with soil, ground and superficial waters pollution. In most places the negative environmental impact is of temporary or local character and related to construction works. Expected that negative environmental impact in considerable scope can be mitigated by proper construction safety measures.

Physical infrastructure such as pipe installation, pumping stations and sewer lines repair will be built and rehabilitated according to rules and standards of construction adopted in the Republic of Uzbekistan.

There are historical monuments and cultural objects located within project area. Location of new constructions and facilities will be selected in a way to minimize any breach of surrounding landscape and existing city infrastructure. Project works area cover only Buyan Kalikhon and Saifidin Bukharzi Mausoleums. It is necessary to note that historical center lacks sewerage network and network of ground waters observance wells is not sufficient.

**5.5 Impacts during Project Implementation and Mitigation Measures**

Rehabilitation and construction works as with regard to sewer system and with treatment plants are considered to be nature protection measures, but they cause small scale environmental impact during the period of their implementation leading to both positive and negative consequences.

*Project potential impact could be the following:*

**5.5.1. Improvement of population health**

the Project will increase reliability of a regular diversion of wastewater coming from households and industrial enterprises, and also its real cleaning capacity at treatment plants that will support improvement of ground and superficial waters quality (by physical and microbiological parameters) and that will lead to decrease of disease rate among population transferred by water.
5.5.2. Water and land resources
During construction and rehabilitation of sewer systems, water resources may be subjected to pollution in course of cleaning and construction works on sewer collectors as well as by wastes from construction objects. For prevention of pollution of superficial and ground waters measures should be undertaken for protection from possible sources of pollution:

- Observance of rules of construction and rehabilitation works and use of modern technology during works;
- Diversion of surface and drainage drains outside the boundaries of construction objects;
- Elaboration and implementation of a plan of wastewater diversion during reconstruction works;
- On-time cleaning of construction objects from building refuse and its utilization.

Measures on protection of all types of water resources from possible sources of pollution should be undertaken during rehabilitation and construction works. Unpremeditated fuel and oil leakage from reservoirs at construction objects as well as wrong treatment of lubricant materials in process of technical servicing are the most probable sources of pollution of superficial and ground waters in project objects.

Pollution will be temporary and will provide insignificant impact on soil and ground waters. Construction works will be conducted within a short period of time and dry weather conditions in Bukhara will assist in limiting their impact on water objects.

The key environmental impact on land resources during the process of rehabilitation and construction works is soil pollution by construction refuse and oil lubricants as well as flooding of adjacent land areas due to possible break-downs and damages of structures. Appropriate fields should be prepared for gathering and storage of construction refuse and sediments in order to reduce negative environmental impact.

Soils may be subjected to pollution by the same sources of pollution, which were mentioned in relation to water resources, namely: incorrect treatment of solid and liquid wastes and improper use of machinery, particularly, during oil replacement and fuel filling.

Use of petroleum and oil lubricants is planned in limited volumes and timeframes, therefore that impact on environment will be insignificant. However, construction practice of works conducting requires provision of measures on preventing from soil and water pollution.

Measures on protection of soils should be undertaken in accordance with norms and rules of the Republic of Uzbekistan. During construction of new collectors the organic upper layer of soil useful for further use should be removed and temporarily stored apart of remaining ground materials. After completion of construction/rehabilitation of collectors the organic soil layer will be used for repeated covering and duly compacted and recovered to initial condition.

5.5.3. Air Quality
Temporary environmental impact of rehabilitation and construction at sewer system objects is related to operation and use of technique and machinery for repair and recover works, it includes: dusting, noise due to trenching, vibrations in old buildings nearby, limited access to buildings, closing separate parts of roads and stoppage of traffic, these impacts’ duration in the process of rehabilitation works in the sewerage network and distribution pipelines will be short term and will touch upon the population living nearby. The impact will be mild both for the personnel and for the environment. Appropriate mitigation and technology control measures for implementing repair works will be adopted.

For mitigation of impact from automobile transport to atmospheric air, measures on strict observance of rules of safety at main crossings, highways, streets and makhallas and around working
objects. Contractors under supervision of PIU should provide temporary or permanent traffic lights on most loaded crossings. During rehabilitation and construction period road police inspection will be strengthened in makhallas as well as measures of prevention and safety among schoolchildren.

Elimination of dusting during works and transportation will be effected by watering areas of working objects and roads. All construction objects and passages should be cleaned after works are done.

5.5.4 Surface vegetation

Scale of damage to trees and vegetable cover will be insignificant. Rehabilitation/construction works at sewer collectors usually means that part of vegetation will be removed and stored along the working area. They could be mitigated by adoption of appropriate measures, namely post-recovery of disrupted vegetation cover.

5.5.5 Solid and liquid wastes management

In the process of repair works implementation at wastewater treatment plants (WWTP), distribution centers and sewer collectors, building wastes will be formed, which require strict collection system, removal and their minimization.

Wastes from grit catcher and silt formed in the process of water treatment can be the source of pollution of soil and waters (ground and surface) during its removal. The following wastes are formed during repair and renewal works of sewerage network:

- Wastes from mechanical treatment of collectors from sediments, consisted of garbage, mineral salts and organic substances;
- Earth wastes from objects preparation for collectors construction;
- Material wastes after damaged pipelines repair.

Wastes usage and storage should be provided at work place. Different types of solid wastes including wood, oil filters, plastic and cardboard boxes will be formed at work objects. Mitigation measures include provision with containers for collection of used oil with further utilization at specially assigned places.

Earth wastes from collectors’ construction will be used for backfill of trenches.

Wastes should be delivered to scrap metal service or recycling at metallurgical plant after replacement of damaged ferroconcrete and cast-iron pipelines. Wastes from repair and recovery works including asbestos-concrete pipes will be in timely manner collected, removed and deposited in specially assigned places (See Appendix 2 “EMP” p.2.1)

Machinery servicing will be done only at fuel filling stations, whether used oils and other liquid contaminants will be stored in specially equipped places. No cars and mechanisms servicing will be permitted at work places.

After works completion all objects should be cleaned and returned into their initial natural condition.

5.5.6. Population and workers

Work methods at rehabilitated and under-construction objects can set dangerous situations for workers and population of nearby settlements nearby. It is necessary to create healthy conditions
observing all regulations for labor safety. Fencing of working objects and bridges with trenches should be provided. Traffic control, emergency signals and illumination should be provided according to local rules. If necessary, safe alternative routings and crossings for pedestrians should be constructed.

For safe chlorination of discharge pipes the control over amount of chlorine discharged into the air and residual chlorine in water will be set up (Safety measures guidelines. Safety at selection of samples and conducting of analysis of waste waters № 1. State Specialized Inspection of Analytical Control of the State Nature Protection Committee of the UzSSR, 1990). The chlorination process used under waste waters decontamination will be implemented according to established measures of safety and regulation of its delivery.

Replacement of old sewerage networks will cause interruptions in reception of wastewater from consumers; damages of other communications (telephone, electricity network) are possible. It is required to undertake necessary measures during recovery works planning and obligatory coordination with appropriate services and enterprises.

5.5.7. Casual findings presenting cultural value

Archaeological and cultural findings are possible as construction works on sewerage network expansion touch upon the territory of old city. In case of archaeological findings, the Environmental Management Plan provides for requirement on publication of special announcements, works termination and order observation of their clearance.

5.6 Long-term Impacts and Mitigation Measures

In general O&M of sewerage infrastructure does not foresee significant risks. Project stipulates anticorrosion measures for mitigation of negative impact of ground waters on sewerage networks and facilities.

Improvement of technical servicing of rehabilitated sewer network and wastewater treatment plants will support reducing pollution of ground and superficial waters, soil and flora and as a result will lead to decrease of disease rate among the population, improve sanitary and epidemiological situation in the city. All of the afore-mentioned will be achieved by combination of strengthening the potential of VK and measures of physical influence.

Effective improvement of technical facilities of VK system is achieved only by reaching mutual understanding and cooperation between system operators and local population. Involvement of operation and service personnel into this job is not less important than drawing attention of high level decision-making bodies and budget managing officials.

Preventive measures related to personnel health protection, engaged in maintenance of project objects stipulate strict following of safety rules and standards on O&M of sewerage infrastructure. Personnel engaged in O&M will be specially trained.

Issues that influence O&M will be decided upon during a detail designing and project implementation. They include the following:

- Improved access to connection of population to centralized system of sewerage.
- Provision of regular energy supply for effective operation of pumping stations and treatment facilities.
- Defining measures, which could be adopted by VK in order to improve interaction with consumers and stimulating participation of wide publicity in the process of desining, monitoring and evaluation of raising effectiveness of the system.
• Provision of inputs into defining the best possible strategy on increasing tariffs within acceptable limits for providing system sustainability.
• Implementation of programs on raising institutional capacity and training of appropriate personnel of Bukhara VK.
6. ALTERNATIVES TO PROPOSED PROJECT INVESTMENTS

The project provides for development of existing sewer system infrastructure by way of construction of new networks and rehabilitation of existing lines. Metal-, polyethylene- or fiberglass-made pipes can be used under construction of new and replacement of old sewer lines. Metal-made pipes are easily exposed to corrosion; they are unstable to impacts caused by aggressive GW and also less transportable and not convenient for assembly. Polyethylene and fiberglass made pipes are light and manufactured of various diameter and length, supplied with unions and fittings; they are suitable for transportation and assembly, not exposed to corrosion and also are durable with total life-span of 50 years.

The use of fiberglass pipes gives a great advantage and convenience for renewal of trunk waterlines and sewer lines by way of pulling through into old pipelines. After having pulled through the pipes, the space between new and old pipes is filled out by early-strength solution. Renewal of sewer pipelines can be provided without stoppage of their operation during the periods of minimal load within section between two wells. Long-lasting storage of pipes at the open air is possible due to high stability characteristics to ultraviolet irradiation. Scratches are allowed on outer surfaces of pipes.

Use of such pipes allows reducing time-frame and labor resources for repair and recovery works, as well as avoiding annual overhaul, improving environmental conditions in the process of reconstruction.
7. ANALYSIS OF POSSIBLE EMERGENCY SITUATIONS

In the city possible emergency situations (break-downs) could be related to breach of integrity of irrigation network, drainage and collector system as well as sewerage facilities that cross channel routes. Such break-downs could be possible due to pipes corrosion as well as natural calamities (earthquakes and etc.). All that does not secure from seepage of polluting substances into the ground, ground waters, soil and to irrigation system collector with further flow into superficial waterways. Simultaneously in places where pipe break-down occurred the adjacent area will be instantly waterlogged. All that will be reflected not only in condition of the flora, but also will cause outbreak of infectious diseases both in animals and among nearby living population. Therefore, in order to provide reliable operation of irrigation and sewerage networks, it is necessary to lay down pipes made of an appropriate anti-corrosion material. In cases of such break-downs and emergencies, it will be necessary to warn the population and provide it with water brought by trucks.
8. FORECAST OF BENEFITS AND STATE OF ENVIRONMENT AFTER PROJECT IMPLEMENTATION

Availability and operation of sewerage infrastructure is nature protection measure preventing pollution of environment with waste waters from population and urban industry. Reconstruction of this structure will only increase its positive impact on environment. This project impact on environment will be mainly positive and negative effects are temporary. Nature of environmental impact during the rehabilitation works and after their completion will vary.

During execution of works air will be polluted by non-organic dust and combustion products from construction and mobile machinery. Ground and soil-plant cover state will be disturbed. Impact on these components of environment will be temporary with reversible consequences. Current proposals summarize impacts and their duration. Further in text it is provided an assessment of condition of WWTPs after the project is stopped. Such summarization is required by Glavgosekpertiza.

Repair and construction of sewerage collectors, their cleaning will cause changes in sewerage collectors mode of operation, which may worse sanitary-hygienic conditions of nearby territories. Impact will be short-term with reversible consequences.

Analysis shows that implementation of project arrangements will allow reduce: (1) costs for operation and maintenance in case of accidents elimination, (2) waste waters losses/infiltration of ground waters, (3) number of sanitary facilities at site, (4) energy capacity of equipment and total energy consumption of BVK. After installation of new system of aeration (new air blowers + new aerators) it is planned to reduce energy consumption for aeration approximately down to 20 KWH/PE60/year and at the same time substantially improve the quality of wastewaters treatment.

Initially, benefits will occur due to cleaning, rehabilitation of sewerage network and its diversion to treatment facilities. At the moment, capacity of collectors is reduced significantly because of pumps, clogs and leakages. Construction of new collectors, flushing and repair of existing network, pumping stations and treatment facilities will allow timely collection of wastewaters and their treatment till standard indices by quality of sewers.

Air Quality
After conducting of planned works, the air quality will improve due to elimination of temporary sources of impacts – construction machinery and automobile transport involved in works.

Superficial and ground waters
Condition of superficial and ground waters will change. Rehabilitation of sewer collectors will impact on GW, which are hydraulically connected with superficial drains.

As a result of rehabilitation/construction of sewerage network, structures, coverage scope of the population connected to the sewer network will increase, coefficient of efficiency of sewer collectors will also increase, and there will be a decrease of loss of drains due to guaranteed and timely drain collection and also due to their standard cleaning. All that will support to reduce discharges of wastewater into superficial and GW. Condition of Sakovich collector water and of Dengizkul lake water quality will improve as it will start to receive wastewater of improved quality after good quality cleaning.

Soils
Due to increase of full-capacity discharge of rehabilitated network wastewater outflow will increase and ground pollution incidence will accordingly decrease. After rehabilitation of sewer collectors, the process of soils salinization will be stopped.
Flora
After sewer collectors have been rehabilitated, soil pollution incidence decreases and condition of GW as well as of flora will change for better. Temporary disrupted cover will be rehabilitated. Decrease of impoundment, pollution of ground and ground waters will lead to improvement of condition of root system of trees and bushes and consequently greenery.

Fauna
During rehabilitation works habitats of different animals, mainly, rodents, lizards and birds nesting in the bushes and trees, growing along the collectors and roads will be disturbed. After completion of works and rehabilitation of greenery they will return back.

Physical cultural heritage
Elimination of seepage at sewer collectors and pumping stations will allow reducing GW level and their possible adverse impact on objects of cultural heritage.

Socio-economic aspects and population health
Socio-economic and living conditions of population will improve. Rehabilitation and expansion of sewer collectors, improvement of sewer infrastructure management will lead to reducing random wastewater discharge from population, it will also decrease superficial and GWs pollution and as a result it will lead to reducing of diseases incidence among population, improving of sanitary and epidemiological situation in the city.

Thus, implementation of the Project comprising rehabilitation of structures and reconstruction/construction of sewer collector, improvement of O&M activity of VK’s services will lead to changing of water regime in the territory and that will be reflected positively at whole complex of natural conditions, objects of cultural heritage and population’s health.
9. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

General objectives of environmental management are the following:

- Implementation of measures on prevention and reducing any possible negative impacts related to proposed investments to admissible extent (level);
- Implementation of measures favoring provision of environmental measures, concurred in the phase with technical ones during implementation;
- Implementation of mitigation measures at stages of construction and O&M;
- Control and monitoring of considerable problems during rehabilitation/construction and operation.

In order to guarantee its effectiveness and practicability, EMP will take into consideration requirements of: World Bank, Uzkomkommkhizmat agency, BVK “Suvokova”, Contractor, representatives of hydro-geologists, territorial committee on nature protection, inspection on preservation of cultural heritage objects.

The Plan will provide for deciding upon issues related to construction and work over sewer-collector structure itself, as well as in line with describing of possible negative impact it will include measures on efficient reducing of negative impacts to the environment. Combined EMP was elaborated taking into account gained experience during implementation of Bukhara and Samarkand Water Supply Project (IBRD/IDA 2004-2009) Appendix 2.

9.1 Environmental Impacts Mitigation Measures

Temporary Land Use
It is supposed that resettlement in view of Project implementation will not be necessary. For minimization of the impact, all Project objects will be designed along the line structures, such as roads. Construction infrastructures, stipulated by project, will not be contrary to other types of existing infrastructure, such as roads, urban infrastructure, both during the construction period and in the future.

Historical, Cultural Objects and Landscape
There are historical monuments or cultural objects at project site, which can probably be discovered during the construction works. It is envisaged that representative of Bukhara regional inspection on protection of cultural heritage objects will monitor permanently construction works at cultural objects location sites.

Measures on Mitigation of Negative Impact on Project Environment are related to temporary and localized disorders because of construction and rehabilitation works. It is provided that most part of revealed mitigation measures on negative environmental impact should be part of ordinary work practice of constructors during the Project implementation and it is therefore the Contractor responsibility to implement these mitigation measures.

As expected, most costs for mitigation of negative impact on project environment will be included into the bidding documents to be prepared by the Feasibility study group.

Project Infrastructure Operation Related Impact
In general, operation of sewer-collector infrastructure does not imply significant risks. Project envisages anticorrosion measures for mitigation of negative impact on ground waters. Project provides anti-seismic measures to decrease seismic load and increase seismic influence resistance.
In order to prevent negative environmental impact, occurred during rehabilitation and construction of sewer collectors, it is foreseen:

**For reduction of air pollution**, the following measures will be taken at construction-rehabilitation and land works site as well as when land transporting:

- Suppression of dust during construction period;
- Non-admission of extra vehicles at site in order to reduce gas and dust;
- Burning of garbage and other materials.

**For protection of soils and ground and surface waters, it is planned:**

- To provide construction sites with ditches for diversion of surface flow and drainage waters, considering their surface is subject to rehabilitation after completion of works;
- To take appropriate measures to prevent leakage of combustive-lubrication materials, all ground-based tanks for combustive-lubrication materials will be placed above the land surface and their walls integrity will be under the constant control. Collection and utilization of used oil products will be in accordance with environmental requirements;
- To develop and implement plan of waste waters diversion during reconstruction, their pumping or bypassing to gravity duct;
- To timely clean construction objects from building refuse and stock them only at places, designated by controlling bodies;
- After excavation and other works at site, soils will be laid in such a way not to prevent water flows and be source of pollution.

**For mitigation of repair-construction works impact on soil, it is envisaged:**

- To improve land after completion of works and removal of temporary crossings, channels, trenches, structures and building refuse;
- To prevent leakages when filling up and transporting combustive-lubricating materials and to provide collection of combustive-lubricating materials and utilization of their remains;
- To organize collection of construction and other wastes (cut trees, paper, glass, plastic, sediments from sewer-collector cleaning, etc.) into separate tanks (special containers) at water resistant (cemented) site before their utilization and disposal to specialized enterprises on processing or storage.

After completion of rehabilitation and construction works, all working sites will be cleaned and planted.

**For protection of flora and fauna** only stipulated roads and temporary sites will be used. No trees or bushes or roadside vegetation will be felled or damaged, besides those requiring felling for execution of works. Contractor should protect trees and greenery from damages. Contractor will be responsible for obtaining permission for any required tree felling and ensuring removal of felled trees. If during execution of works Contractor finds out tree or certain trees are subject to felling and have cultural or religious value, he should immediately inform Engineer and wait for his instructions on further clearing.

To recover lost vegetation works on its rehabilitation will be conducted. There won’t be any significant impact on ground-based fauna during project implementation.

**Preventive measures concerning health protection of personnel**, operating Project objects, suppose strict following of security rules and normative documents for operation and maintenance of treatment facilities and sewerage infrastructure. Personnel, engaged in O&M, will be specially trained.
Working methods at rehabilitated and built objects may cause dangerous situations for the personnel and population of nearby settlements. Fencing of work objects and bridges over the trenches will be provided. Traffic control, emergency alarms and lightening will be organized in conformity to local rules. Safe bypass roads and crossings for pedestrians and vehicles will be created if necessary.

9.2 EMP Implementation Arrangements

Monitoring will be conducted in order to verify whether project activity corresponds to national environmental standards and procedures, how project impacts environment. Monitoring will focus on construction and rehabilitation works, pipelines cleaning, following work execution schedule and plan. In order to provide non-stop execution of repair and construction works the following clauses should be considered in the contract with contractor:

- Introduction of new efficient materials and structures as well as works execution techniques in the construction.
- Foresee creation of safe and healthy conditions, easing work and precluding accidents.
- Putting into operation of rehabilitated objects not corresponding to environmental requirements is prohibited.
- Determination of sequence of rehabilitation works at pipelines, considering minimization of local inconveniences.
- Determination of construction methods applying fencing of work sites and envisaging of crossing bridges over separate trenches.
- Maximum provision of appropriate access to working and living places.
- Request contracting company to assure safe displacement and installation of devices.
- Request contacting company to use redistribution of traffic at work area. Traffic management, emergency alarms and lightening should be established according to local Rules. Consider safe bypasses and crossings for pedestrians and vehicles if necessary.

Responsibility for taking mitigation measures is laid on Contractors. Measures on Section “A” and “B” of EMP will be taken by BVK services during repair and construction works and objects maintenance. These works will be coordinated by Operator under the service contract. PIU under the “Uzkommunkhizmat” agency will coordinate their activity, manage, administrate, conduct monitoring and evaluation of Project impact as well as provide execution of fiduciary measures. Order of monitoring conducting and responsible people for its execution are determined in Appendix 2.

Implementation of works under the Section “C” of EMP, including establishment of water protection areas; removal of environmentally potentially dangerous objects-pollutants from water protection areas; monitoring of surface (Sakovich collector), ground waters and pollution sources (requiring additional equipping of laboratories) state; increase number of observation wells for ground waters level control is entrusted to local administrations and specially authorized state bodies (State Nature Protection Committee, Ministry of Agriculture and Water Resources, Ministry of Geology, Uzkommunkhizmat, etc.).

9.3 Environmental Monitoring Actions

Monitoring over environment condition will be organized using uniform scheme and taking into account requirements of nature protection.

Environmental Monitoring Plan specific objectives are the following: (i) collecting samples and data on project area; (ii) collection and processing of additional data necessary for creation of analysis.
system and for transparent, effective information reporting which allows identifying impacts of the Project.

Environmental monitoring during Project implementation will provide for observation over:

- Quality of GW and superficial waters in sites of upper and lower parts of project area;
- Quality of air (dust, exhaust gases) close to work sites;
- Movement of transport and provision of operating safety;
- Impacts on flora and fauna;
- Monitoring of treated wastewater.

Key organizations implementing state monitoring in the Republic of Uzbekistan are the following:

- SE UzGIDROINGEO and its territorial subdivisions (monitoring over the level of GW, mineralization of GW);
- Uzgidromet under the Cabinet of Ministers (monitoring of the quality of the superficial waters of main rivers, atmospheric air, soils and meteorological monitoring);
- Goskomptiroda (environmental monitoring over: fauna, flora, control over polluting substances monitoring).

Monitoring of the level of GW is conducted by regional subdivision of Hydro geological station, laboratory of which fulfills measurements from wells located on the territory of the city every month. Besides GW depth measurements, sampling from these wells also conducted for identifying GW mineralization rate. Hydro geological station (HGS) conducts regular monitoring of salinization by basic ions (chlorides, sulfates, calcium, magnesium and etc.).

Environmental monitoring is conducted by the State specialized inspection of analytical control (GosSIAK) of Goskomptiroda of the Republic of Uzbekistan and its branch offices. Monitoring is carried out by: fauna, flora, air quality at pollution sources, superficial waters and sources of their pollution, soils.

For assessment of Project’s potential impact on environment condition it is necessary to track the level of GW occurrence and, water quality in Sakovich collector and etc. as well as city waterways.

Monitoring plan consists of:

*Monitoring of the level of occurrence and mineralization of GW* is conducted within city boundaries regularly and monthly. Identified parameters: pH, suspended solids, electro conductivity, ions of salts (sulfates, hydro carbonates, chlorides, sodium, potassium, calcium, magnesium), mineralization, rigidity.

*Monitoring of water quality* in Zaravshan River (monthly sampling) will be continued by Uzgidromet. Information on water quality will be used for assessment of impacts of project works on river water quality. Determinable ingredients: pH, suspensions, electrical conduction, salt ions (sulfates, chlorides), mineralization, hardness, biological oxygen demand (BOD), chemical oxygen demand (COD), biogenic elements (nitrates, nitrites, ammonium, phosphates and others), pesticides (DDT, α-HCCH), oil products, phenol and others.

*Monitoring of water quality in Sakovich collector* and treated wastewater discharged it will be conducted by the Central laboratory under BVK every ten days. Identified parameters: pH, suspended substances, salt ions (sulfates, chlorides), mineralization, rigidity, biological oxygen demand (BOD), chemical oxygen demand (COD), biogenic elements (nitrates, nitrites, ammonium, phosphates and etc.), pesticides (DDT, α-HCCH), oil products, phenol. Laboratories didn’t master methods of given ingredients determination and do not have sufficient equipment to conduct their analysis. Enhancement of laboratory capacity is provided.
9.4 Capacity Building and Training

During implementation of Sewerage Project in Bukhara city it is provided to improve capacity of VK in matters of O&M of sewer systems.

Measures on strengthening institutional potential leads to a series of reforms of sector policy and conducting of trainings such as:

- Review of existing tariffs and financial policy sector in order to give an opportunity to the VK to achieve financial independence, i.e. rely on combination of incomes from operational activity and allocations from the state budget sufficient to cover all O&M costs as well as costs for debt pay-off on proposed Project on sewerage rehabilitation;

- Raising the capacity of VK on conducting coordinated tariff policy in effective and sustainable manner. Essentially, such an increase of the capacity will include: full inventory of the property within bounds of service of Bukhara VK for revealing incidents of unregistered connections and evaluation of demand for installation of counting devices (meters); counters installation itself; permanent improvement of VK’s capacity on introduction of bills and collection of payments for water supply and sewerage services; personnel trainings in each of the sphere of activity.

- Additional training to various aspects of operation of water supply and sewerage systems, including study tours to similar enterprises abroad.

Implementation of the above-mentioned measures will allow improvement of O&M of sewerage infrastructure, increase reliability of regular diversion of drains from population, industrial enterprises and organizations, their standard treatment at treatment facilities which will further improvement of ground and surface waters quality. In general, project area will observe improvement of environmental condition as a result of BVK capacity improvement, prevention of operation problems as well as increase of life cycle of sewerage system. All these measures will allow reducing negative impact of sewage on environment.
10. COSTS FOR MONITORING AND ENVIRONMENTAL MANAGEMENT PLAN (EMP)

Environmental and social importance of project area assures specific protection of environment and mitigation measures which are included into the total project cost budget. This budget will cover preventive activity or necessary mitigation measures aimed at overcoming of impacts related to construction as well as development of capacity on environmental management/monitoring in PIU. Further these types of activity should be determined at development of feasibility study and detail designing of engineering works.

Estimated expenses for EMP implementation include the following:

*Costs for monitoring over WTTP operation* and of discharged treated drains comprise at average 34 thous. USD per year, including costs for procuring chemical reagents – 3.4 thous. USD. Forecasted cost for adaptation of new solutions on conducting chemical analysis (mastering of methods of determination of new ingredients in waste waters and watercourses as it was mentioned before laboratory has limited list of determinable pollution indices) and purchasing of chemical reagents will comprise approximately 5 thous. USD.

*Monitoring of occurrence of GW* requires increase of number of wells for observation over condition of territories of historical and cultural monuments. Forecasted costs for drilling of 5 observation wells will comprise approximately 10 thous. USD.

It is recommended that during elaboration of the working project on sewerage in city of Bukhara, it is necessary to provide for costs on fencing WWTPs’ territory, as they are located in Bukhara raion on the territory of Kozi Said farm. Access to the WWTP’s territory is open, and area is not under surveillance. According to existing norms, sanitary zone of treatment plants with capacity exceeding 50 thous. m³/day should comprise not less than 500 meters to any living structures. WWTP’s area shall be fenced.

*Costs for sharing knowledge and experience*
Input of Bukhara and Samarkand Sewerage Project in the city of Bukhara in terms of sharing experience and knowledge, which will be conducted in conference halls at main WWTPs in Bukhara will comprise 100 thousand USD.

*Costs for public awareness campaign*
For this purpose it will be necessary to allocate 50 thousand USD.

*Costs for WWTP personnel training* abroad are estimated in the amount of 50 thousand USD.

Forecasted expenses for implementing works on monitoring and EMP will be clarified in the process of elaboration of Feasibility Study and of working projects.
11. ENDORSEMENT (COORDINATION) AND PUBLICATION OF EMP

During the process of environmental assessment and social assessment in the city of Bukhara on 14 April 2009 key stakeholder organizations and representatives of non-governmental non-commercial organizations (NGO) were invited to discuss preliminarily proposed project activities under EIA and expected social and environmental impacts on environment by the side of Bukhara and Samarkand Sewerage Project. Minutes of the workshop with the list of participants is presented in Appendix 3.

Environmental issues
Natalya Limankina (expert/developer of EIA) has presented workshop participants with the objectives of the research over EIA, research components, description of current state of environment as well as key existing problems with regard to the environment in city of Bukhara. She has concluded expected positive and negative impacts, which could be caused by the proposed Project, as well as proposed mitigation and environment management measures. Besides, she informed on the system of monitoring over project implementation as well as environmental monitoring. Presentation of preliminary environmental assessment of the Project generated only one question from a participant, who claimed that if all measures on implementing Environmental Management Plan were realized, then it would have been a great burden for project budget. It was proposed to set priorities for mitigation measures within proposed EMP.

A lot of questions were raised with regard to problems of sewerage and drainage and accordingly solutions were proposed on that matter. Representatives of the VK explained that drainage does not fall under their sphere of responsibility and they cannot be united as it will only worsen the operation of the sewer system and of wastewater treatment plants.

Notwithstanding variable ideas of participants and proposals on certain issues related to rehabilitation of sewerage system, all of them agreed that the existing sewerage system causes many social, sanitary problems for population. Workshop participants were especially worried that the current state of the sewer system can pose a threat to unique constructions located in old city’s historical part. All participants unanimously supported the Project and expressed their gratitude to the World Bank, which provided funds accessible for Uzbek Government for Project implementation.

The information on the starting of Bukhara and Samarkand Sewerage Project and elaboration of EIA was beforehand presented to local press editions and published in “Buhoronoma” newspaper (See Appendix 3).
12. CONCLUSIONS

Draft report on Environment Impact Assessment by Rehabilitation of treatment facilities and sewerage pumping stations of Bukhara city was prepared basing on analysis of ecological condition of environment, project decisions and consideration of expected impact consequences from implementation of conducted activities.

Complex assessment, conducted on nature components, showed number of problems related to condition of urban treatment facilities and sewerage systems on the territory of the city:

- Pollution of soils and grounds, ground waters because of non-arranged discharge of waste waters without treatment or low efficient treatment;
- Subsidence caused by leakages of sewerage and water pipeline networks, precipitations, leading to humidification of grounds;
- Increase of ground water level as a result of leakages of sewerage systems in case of accidents, which leads to infiltration of untreated waste water into ground waters.

Analysis of current condition of urban treatment facilities and sewerage system showed their high depreciation. Buildings and structures, electromechanical equipment at WWTP of Bukhara city as well as sewerage pumps, flow meters, screens, grit chambers and aeration system at biological treatment stage are in very bad physical condition and have low efficiency. Electric power supply of WWTP is casual and available energy is often not sufficient for proper treatment of waste waters. As a result, treated waste waters do not meet established standards of maximum admissible discharge.

At present only about 50% of Bukhara city (including near located Kagan city) is connected to sewerage system.

Population of Bukhara city, not connected to sewerage system (i.e. about 150,000 people) use cesspools in their plots and septic tanks of doubtful standards. Cesspools are mainly made without filtration screen which enables filtration of waste waters into the ground and ground waters polluting them.

In order to solve out all the above-mentioned problems on the territory of the city, related to sewerage and in order to improve functioning of urban treatment facilities and sewerage systems, rehabilitation works at sewerage pumping stations, reconstruction or replacement of sewerage pipes being in unsatisfactory condition, installation of new screens and efficient grit chambers, new automatic sampling devices, new aeration system, reconstruction of laboratory are provided by the project.

Rehabilitation and construction works at both sewerage network and treatment facilities are actually nature protection measures.

Implementation of these measures on Reconstruction/expansion of sewerage networks, pumping stations and WWTP component will lead to improvement of quality of transferred waste waters, stop of leakages, elimination of infiltration of non-treated waste water from sewerage pipes into the ground/ground waters, increase of number of connections to sewerage system, which in its turn decreases unorganized waste waters discharge to environment and reduce negative impact on soils, grounds and ground waters. Rehabilitation of sewerage collectors will suspend the process of soils salinization improving greenery condition.

As for the component “Development of institutional capacity of Bukhara Vodokanal (BVK)”, procurement of modern cesspool trucks, equipment for washing and cleaning of sewerage pipes, excavator for quick repair, modern workshop and maintenance equipment are considered by the project, which will improve further O&M of reconstructed sewerage system. These measures will allow reducing of negative impact of sewerage wastes on environment.

Component “Increase of public awareness” will provide development of informational strategy and increase of potential to conduct mass media campaign and implement program on communities and
civil society preparation. Proposed measures will include broad range of components from booklets, posters and campaigns in local schools to information distribution on radio and television.

Assessment of emergencies showed that disturbance of sewerage collectors and facilities integrity, route crossing channels because of pipes corrosion as well as natural disasters may lead to pollution of grounds, ground waters, soils, collector of ameliorative system and then surface water flows as well as impoundment of the territory in places of pipes break. This in its turn will reflect not only on greenery condition but may cause episodes of infection diseases both at animals and near living population. In order to reduce environment impact of such emergency situations it is necessary to lay pipes of appropriate anticorrosion material.

In order to reduce possible negative consequences of project impact on environment, mitigation measures plan for the period of works conduction, ecological monitoring and environment condition management plans were developed under EIA project.

Thus, conducted complex analysis of revealed impact consequences from project implementation, consisting of facilities rehabilitation, reconstruction and construction of sewerage collectors, improvement of management and maintenance by Vodokanal services will lead to change of water regime of the territory which will affect positively the entire complex of nature conditions, cultural heritage objects and population’s health.
APPENDICES:
APPENDIX 1. ZARAVSHAN RIVER WATER QUALITY A

![Bar chart showing Zaravshan River water quality from 1988 to 2006 at different points.]

- Zaravshan River, Rovat-Khoja site
- Zaravshan River, (Karadarya), lower Taligulyan discharge point
- Zaravshan River, lower «Navoiazot» enterprise’s discharge point
## APPENDIX 2. ENVIRONMENTAL MANAGEMENT PLAN – Mitigation Plan

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<th>Mitigation Measures</th>
<th>Responsible organizations</th>
<th>Additional environmental costs</th>
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<td>Environment</td>
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<tr>
<td>Repair and reconstruction of pumping stations, waste water treatment plants, distribution centers and pipelines</td>
<td><strong>1. Water resources</strong></td>
<td>Working out of regime of waste waters reception and their taking to waste water treatment plants for the period of works execution</td>
<td>Feasibility study group, Contractor</td>
<td>Costs for revealed actions and requirements will be included into the working documents of Contractor</td>
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<tr>
<td></td>
<td><strong>1.1. Water resources</strong></td>
<td>• Working out of project components of works production; • Adoption of new effective materials and constructions, technologies of works conducting; • Observation of repair and renewal regulations and rules; • Storage of sediments/wastes, only in established places</td>
<td>Feasibility study group, Contractor</td>
<td>Costs for revealed actions and requirements will be included into the working documents of Contractor</td>
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<td><strong>1.2. Waters (underground and surface) contamination by sediments from waste water treatment plants and distribution centers</strong></td>
<td>• Provision with derivation of superficial and drainage flows from construction sites. • Timely treatment from building refuses; • Recovery works implementation at affected places.</td>
<td>Contractor, PIU</td>
<td>Costs for revealed actions and requirements will be included into the working documents of Contractor</td>
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<td><strong>1.3. Waters contamination from construction sites</strong></td>
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<td><strong>2. Land resources</strong></td>
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<td><strong>2.1. Soil contamination by building refuses and sediments.</strong></td>
<td>Organization of timely collection of repair and renewal wastes, sediments from treatment, their dispatch and storage in established places. Silt utilization in the capacity of fertilization for cotton plants.</td>
<td>Contractor, PIU</td>
<td>Costs for revealed actions and requirements will be included into the working documents of Contractor</td>
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<td><strong>2.2. Fuel and oil leakage</strong></td>
<td>• Containers for fuels and lubricants should be filled according to established regulations; • Not to admit oil products discharge to relief; • To observe rules of filling and transportation.</td>
<td>Contractor, device operators</td>
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<td>Stage</td>
<td>Problem</td>
<td>Mitigation Measures</td>
<td>Responsible organizations</td>
<td>Additional costs environmental costs</td>
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<td>2.3. Sewerage pipe break and land flood</td>
<td>Urgent works implementation on pipeline and earth reconstruction.</td>
<td>Contractor, PIU</td>
<td>Costs for revealed actions and requirements will be included into the working documents of Contractor</td>
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<td>Air quality</td>
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<td>3.1. Dustiness from earthwork</td>
<td>Watering of roads, repair and renewal operations and appropriate covering for transport while of wastes transportation.</td>
<td>Contractor, Drivers of appropriate machinery, PIU</td>
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<td>3.2. Contamination by exhaust gases from functioning aggregates and motor transport</td>
<td>Control for physical cars condition. Observation of rules filling.</td>
<td>Contractor, Drivers of appropriate machinery.</td>
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<td>3.3. Noise, vibration from functioning machines.</td>
<td>Observation of exploitation demands.</td>
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<td>Flora</td>
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<td></td>
<td>Damage of trees and vegetation cover</td>
<td>All the damaged vegetation is subject to recovery. Decorative trees damaged during conduction of repair-and-renewal operations will be substituted.</td>
<td>Contractor</td>
<td>Costs for revealed actions and requirements will be included into the working documents of Contractor</td>
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<td>5.</td>
<td>Physical cultural heritage</td>
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<td>Casual findings representing cultural value.</td>
<td>Works termination, announcing of interested organizations, and their extraction according to established rules.</td>
<td>Contractor, PIU</td>
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<td>Territories underflooding and negative impact on cultural heritage objects.</td>
<td>Leakage and accidents removal at sewer collector</td>
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<td>B. Exploitation and maintenance</td>
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<td>Water treatment plants for waste waters</td>
<td>Employees of treatment facilities, BVK.</td>
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<td>Soil and water contamination by silt sediment.</td>
<td>Strictly regulated collection and disposal of sediments in established places, their utilization.</td>
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<td>Leakage of flows while of transportation.</td>
<td>Timely revealing of disrepairs at the network, leakage liquidation in short terms, control for observation of wastes discharge.</td>
<td>Local personnel of BVK</td>
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</table>
|                                           | Exploitation of water treatment plants and sewerage networks                                                                                                                                              | • To work out timely environmental and other criteria, regulating maximum acceptable loads on environment  
• Observe regime of treated waste waters disposal and established regulations of their quality, water object protection from contamination.  
• To conduct technological, forest reclamation, hydro technical, sanitary technical measures in concurrence with bodies of state control  
• To implement disposal of domestic, drainage and other waste waters with permission of nature protection bodies in established order;  
• To observe sanitary protection zone at WWTP;  
• To adopt wasteless and low-wasted technologies, to shorten formation of waste products and domestic wastes, to make their disinfection, processing, to observe rules of their sorting, storage, disposal and utilization. | Local personnel of BVK                                                                      | Provided by     | Local administrations and BVK financing |
<p>|                                           | Social-economic aspects                                                                                                                                                                               | Exploitation of water treatment plants and hygiene of labor                                                                                                                                                                                                      | Local personnel of BVK                                                                      |                  |                     |
|                                           | Exploitation of water treatment plants and hygiene of labor                                                                                                                                               | To work out complex program on improvement of condition of accident prevention and hygiene of labor for maintenance staff                                                                                                                                      | Local personnel of BVK                                                                      |                  |                     |</p>
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<td>Exploitation of decontaminating equipment with observation of established regulations.</td>
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<td>Khokimiyat, Nature protection agencies, State Land Committee agencies, regional agriculture and water department agencies, heads of enterprises.</td>
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<td>Re-equipment of Bukhara Vodokanal hydro chemical monitoring laboratory.</td>
<td>Insufficient monitoring for specific ingredients in waste waters.</td>
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<td>Insufficient monitoring for underground waters level. Increase of number of observation holes and monitoring for quality of underground waters.</td>
<td>Uzkmunnkhizmat PIU, Bukhara hydro geologic station, BVK</td>
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<td>Environment</td>
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<td></td>
<td>1. Water resources</td>
<td>Working out of regime of waste waters reception and their taking to waste water treatment plants for the period of works execution</td>
<td>Contractor</td>
<td>Current technical control and supervision for repair-and-renewal operations</td>
<td>Operator, Bukhara Vodokanal, PIU, local agency on control for repair-and-renewal operations implementation, inspection on protection of cultural heritage objects, local bodies of nature preservation, geology.</td>
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<td>1.1. Regime changing of waste waters reception into sewerage system and waste water treatment plants</td>
<td>• Working out of project components of works production; • Adoption of new effective materials and constructions, technologies of works conducting; • Observation of repair and renewal regulations and rules; • Storage of sediments/wastes, only in established places</td>
<td>Contractor</td>
<td>Current technical control and supervision for repair-and-renewal operations</td>
<td>Operator, Bukhara Vodokanal, PIU, local agency on control for repair-and-renewal operations implementation, inspection on protection of cultural heritage objects, local bodies of nature preservation, geology.</td>
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<td></td>
<td>1.2. Waters (underground and surface) contamination by sediments from waste water treatment plants and distribution centers</td>
<td>• Provision with derivation of superficial and drainage flows from construction sites. • Timely treatment from building refuses; • Recovery works implementation at affected places.</td>
<td>Contractor</td>
<td>Frequently, in the course of repair-and-renewal operations</td>
<td>Operator, Bukhara Vodokanal, PIU, local agency on control for repair-and-renewal operations implementation, inspection on protection of cultural heritage objects, local bodies of nature preservation, geology.</td>
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<td>1.3. Waters contamination from construction sites</td>
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<td>Stage</td>
<td>Problem</td>
<td>Mitigation Measures</td>
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<tr>
<td>2. Land resources</td>
<td>2.1. Soil contamination by building refuses and sediments.</td>
<td>• Organization of timely collection of repair and renewal wastes, sediments from treatment, their dispatch and storage in established places. Silt utilization in the capacity of fertilization for cotton plants.</td>
<td>Contractor</td>
<td>Frequently in the course of repair-and-renewal operations</td>
<td>Operator, Bukhara Vodokanal, PIU, local agency on control for repair-and-renewal operations implementation, inspection on protection of cultural heritage objects, local bodies of health inspection service and nature preservation.</td>
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<td>2.2. Fuel and oil leakage</td>
<td>• Containers for fuels and lubricants should be filled according to established regulations; • Not to admit oil products discharge to relief; • To observe rules of filling and transportation.</td>
<td>Contractor, working mechanisms</td>
<td>Current technical control in the period of repair-and-renewal operations</td>
<td>Operator, Bukhara Vodokanal, PIU, local agency on control for repair-and-renewal operations implementation, inspection on protection of cultural heritage objects, local bodies of health inspection service and nature preservation.</td>
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<tr>
<td></td>
<td>2.3. Sewerage pipe break and land flood</td>
<td>Urgent works implementation on pipeline and earth reconstruction.</td>
<td>Contractor</td>
<td>Frequently, in the course of repair-and-renewal operations</td>
<td>Operator, Bukhara Vodokanal, PIU, local agency on control for repair-and-renewal operations implementation, inspection on protection of cultural heritage objects, local bodies of health inspection service and nature preservation.</td>
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<td>inspection service and nature preservation.</td>
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<td>3. Air quality</td>
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<td>3.1. Dustiness from earthwork</td>
<td>Watering of roads, repair and renewal operations and appropriate covering for transport while of wastes transportation.</td>
<td>Contractor, drivers of appropriate cars.</td>
<td>Frequently, in the course of repair-and-renewal operations</td>
<td>Operator, Bukhara Vodokanal, PIU, local agency on control for repair-and-renewal operations implementation, inspection on protection of cultural heritage objects, local bodies of health inspection service and nature preservation.</td>
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<tr>
<td>3.2. Contamination by exhaust gases from functioning aggregates and motor transport</td>
<td>Control for physical cars condition. Observation of rules filling.</td>
<td>Contractor, drivers of appropriate cars.</td>
<td>Frequently, in the course of repair-and-renewal operations</td>
<td>Operator, Bukhara Vodokanal, PIU, local agency on control for repair-and-renewal operations implementation, inspection on protection of cultural heritage objects, local bodies of health inspection service and nature preservation.</td>
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<tr>
<td>3.3. Noise, vibration from functioning machines.</td>
<td>Observation of exploitation demands.</td>
<td>Contractors</td>
<td><em>Frequently, in the course of repair-and-renewal operations</em></td>
<td>Operator, Bukhara Vodokanal, PIU, local agency on control for repair-and-renewal operations implementation, inspection on protection of cultural heritage objects, local bodies of health inspection service and nature preservation.</td>
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<td>bodies of health inspection service and nature preservation.</td>
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<td>4. Flora</td>
<td>Damage of trees and vegetation cover</td>
<td>All the damaged vegetation is subject to recovery. Decorative trees damaged during conduction of repair-and-renewal operations will be substituted.</td>
<td>Contractor</td>
<td>After works termination</td>
<td>Operator, Bukhara Vodokanal, PIU, local agency on control for repair-and-renewal operations implementation, inspection on protection of cultural heritage objects, local bodies of health inspection service and nature preservation.</td>
</tr>
<tr>
<td>5. Physical cultural heritage</td>
<td>Casual findings representing cultural value.</td>
<td>Works termination, announcing of interested organizations, and their extraction according to established rules.</td>
<td>Contractor</td>
<td>Constantly, on Permanently, as far as such extraction would take place</td>
<td>Project operator, Bukhara Vodokanal, PIU, local agency on control for protection of cultural heritage objects.</td>
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<td></td>
<td>Territories underflooding and negative impact on cultural heritage objects.</td>
<td>Leakage and accidents removal at sewer collector</td>
<td>Contractor</td>
<td>Frequently, in the course of repair-and-renewal operations</td>
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<td>Stage</td>
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<td>technically justified by quantity of work places and their organizations.</td>
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<td>repair-and-renewal operations implementation</td>
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<td>B. Exploitation and maintenance</td>
<td>Environment</td>
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<td>Water treatment plants for waste waters</td>
<td>Soil and water contamination by silt sediment.</td>
<td>Strictly regulated collection and disposal of sediments in established places, their utilization.</td>
<td>Workers of water treatment plants, Bukhara Vodokanal</td>
<td>Regularly, on established schedule.</td>
<td>Operator, Local personnel of Bukhara Vodokanal, organs of nature preservation, health inspection service.</td>
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<tr>
<td>Leakage of flows while of transportation.</td>
<td>Underflow, pollution of water and ground.</td>
<td>Timely revealing of disrepairs at the network, leakage liquidation in short terms, control for observation of wastes discharge.</td>
<td>Local personnel of Bukhara Vodokanal</td>
<td>Frequent control</td>
<td>Operator, Local personnel of Bukhara Vodokanal, organs of nature preservation, health inspection service.</td>
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</tbody>
</table>
| Exploitation of water treatment plants and sewerage networks | Contamination of water resources, grounds, environmental condition and population’s health | • To work out timely environmental and other criteria, regulating maximum acceptable loads on environment  
• Observe regime of treated waste waters disposal and established regulations of their quality, water object protection from contamination.  
• To conduct technological, forest reclamation, hydro technical, sanitary technical measures in concurrence with bodies of state control  
• To implement disposal of domestic, drainage and other waste waters with permission of nature protection bodies in established order; | Local personnel of Bukhara Vodokanal | Every decade monitoring for discharge of treated waste water  
Current control by bodies of nature protection on observation of conditions of waste disposal | Operator, Local personnel of Bukhara Vodokanal, organs of nature preservation, health inspection service. |
<table>
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<tr>
<th>Stage</th>
<th>Problem</th>
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<td></td>
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<td>• To observe sanitary protection zone at WWTP; • To adopt wasteless and low-wasted technologies, to shorten formation of waste products and domestic wastes, to make their disinfection, processing, to observe rules of their sorting, storage, disposal and utilization.</td>
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<td><strong>Social-economic aspects</strong></td>
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<td>Exploitation of water treatment plans and sewerage networks</td>
<td>Condition of accident prevention and hygiene of labor</td>
<td>To work out complex program on improvement of condition of accident prevention and hygiene of labor for maintenance staff</td>
<td>Local personnel of Bukhara Vodokanal</td>
<td>Frequent control</td>
<td>Operator, Local personnel Bukhara Vodokanal, health inspection service.</td>
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<td>Decontamination of treated waste waters</td>
<td>Health hazard of personnel</td>
<td>Exploitation of decontaminating equipment with observation of established regulations.</td>
<td>Local personnel of Bukhara Vodokanal</td>
<td>Every decade control</td>
<td>Operator, Bukhara Vodokanal, bodies of health inspection service.</td>
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<td>C. Additional measures</td>
<td><strong>Environment</strong></td>
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<td>Establishment water protection zone of collector “Sakovich”</td>
<td>Water resources contamination</td>
<td>• Preparation of the Regulation about establishment of water protection zone (WPZ) of collector “Sakovich” • Removal of sources of pollution determined by Regulation from WPZ</td>
<td>Khokimiyat, bodies of nature protection, Goskomzem, Obislovodhzoek, enterprises heads</td>
<td>Frequent control</td>
<td>Bodies of nature preservation.</td>
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<tr>
<td>Re-equipment of Bukhara Vodokanal hydro chemical</td>
<td>Insufficient monitoring for specific ingredients in waste waters.</td>
<td>Laboratory equipment with devices and methods for specific ingredients determination.</td>
<td>Uzkmunnkhhizmat, PIU, Bukhara Vodokanal</td>
<td>Regularly</td>
<td>PIU, Bukhara Vodokanal, bodies of nature preservation.</td>
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<td>Stage</td>
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<td>monitoring laboratory.</td>
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APPENDIX 3. MINUTES OF PUBLIC DISCUSSIONS

Public Discussion of the Report on Environmental Impact Assessment within Bukhara and Samarkand Sewerage Project (BSSP) in the city of Bukhara

Minutes of Public Discussion

Bukhara City, Conference hall of City Khokimiyat 14 April 2009

Objectives:

- To provide population of the city, wide publicity including NGOs, relevant stakeholders with information about proposed BSSP Project activities.
- To inform stakeholders and other participants on REIA.
- To discuss the potential adverse environmental impacts arising from proposed Project’s interventions (including issues related to preservation of objects of cultural heritage and resettlement issues).

Copies of full REIA with EMP for inter-departmental coordination and appropriate comments were previously handed over to the Customer BVK “Suvokova”. Copies of summary information on EIA prepared in Russian were distributed to all participants at the beginning of the meeting.

Key Issues Discussed:

The Joint public discussion was opened by the Deputy Khokim (Mayor) of Bukhara City, Mr. Khakim Khashimov.

A. Presentation of technological part of the Project

The Deputy Head of the Bukhara Municipal Water Utility (Suvokova), Mr. Ruziev, then gave a brief overview of the planned Bukhara and Samarkand Sewerage project - key technical details, planned activities, main areas where (re)constructions are planned and most challenging project sites (mentioning in particular the Sharq Massive).

Next, the Head of Suvokova’s Wastewater Treatment Plant Department, Mr. Saidov, presented the most pressing problems in the current treatment of wastewater, particularly in the cleaning of chemical substances. He explained that the use of outdated technology represents the main obstacle to effective treatment of sewage. The BSSP therefore foresees to replace old equipment with modern, more effective and efficient technology (in particular new aeration tanks). He also pointed out problematic of unauthorized industrial discharges of chemical polluting substances from nearby plants (textile manufacturing), which results adversely in wastewater treatment operations at WWTPs.

Discussion 1:

Workshop participants were mainly interested in how the project would affect the historical part of the city. They expressed the view that the project’s main focus should be on protecting the old town, given its cultural and economic significance. The old town is located at a lower level than the rest of the town, which implies that all sewage flows down to the
city’s historical part, causing damage to its monuments. Several participants (Mr. Ostonov, Mrs. Shodieva, Mr. Safarov, Mr. Kadirov), therefore argued that the entire old town should be covered under the project. Mr. Ruziev replied that the old town could not be completely covered because streets in the historic city are very narrow, which makes it very difficult to dig trenches and lay sewerage pipes.

Several participants, primarily, residents of historical part of the city proposed to include a special component into the BSSP on the construction of public toilets, since there are almost no toilets in the historic part of the city, which is a great inconvenience for the city’s numerous tourists (Mr. Safarov, Mrs. Mirzaeva).

Mr. Ostonov drew attention to the fact that a lot of schools and other public buildings are not connected to the central sewerage system. Schoolchildren have to use outdoor toilets even in winter and are exposed to unsanitary conditions, leading to health problems (such as diphtheria and etc.). The project should therefore as a priority cover schools and other public infrastructure - and not residential areas.

A number of workshop participants stated that sewerage-related problems had been getting worse in the past few years and needed to be tackled without delay. They proposed that Vodokanals find some low-cost solutions for the most pressing problems, given that the project doesn’t cover the entire city and the introduction of new technologies will take time. One concrete measure that was proposed concerned the improvement of cesspools – increasing their quality, thereby reducing leakages and making them better accessible for collection cars.

Project beneficiaries were also interested in the sustainability of the project. The Vodokanal representatives replied that the new pipes which will be installed under the project would last at least for 40 years.

Participants presented multiple views with regard to concrete sites of their interest that could be covered by the proposed project, stressing on the areas of their residence.

Other relevant discussions (Discussion):

**Drainage:** Throughout the workshop, the issue of drainage was raised by several participants. Workshop participants argued that the problems of sewerage and drainage are closely interrelated, and therefore the latter should also be addressed through the project. In a nutshell, the problem is the following: A lot of water comes into Bukhara, but there is no way how it can leave the town. All water is thus “collected” in the city. Insufficient drainage makes the soil very soft, which in turn poses a problem for the building of roads (the city’s number one public service problem). In some suburbs of Bukhara, water is even coming into houses and eroding their fundaments.

Stakeholders put forward several solutions to the drainage problem. One participant proposed opening main ways in order to let the water out of the city. Another participant suggested restoring the old system of drainage holes for waste water, which was liquidated in 1980s. A third participant inquired whether the sewerage and drainage system could not be combined. Vodokanal representatives responded that drainage doesn’t fall under their responsibility. They also explained that sewerage and drainage systems cannot be united because the more the sewerage system is filled with water, the less effective it becomes.

**Resettlement:** With regard to possible (if unlikely) resettlements under the BSSP, stakeholders remarked that Government legislation clearly prohibits households to occupy land illegally. A national program foresees to remove all kinds of constructions (houses,
garages, household plots, fences etc) on illegally occupied land. The Hokimiyat has the right to confiscate land that has been illegally occupied and destroy the constructions on it. A communication campaign is currently carried out among the Bukhara’s citizenry to raise their awareness about this issue.

If land users possess legal land titles and have to be resettled, they will be compensated, whereby each resettlement case would be solved on an individual basis. This gives the makhalla another important part to play: Makhalla Committees should, on the one hand, convince land users to give up their claims and leave the land to the project and, on the other hand, find satisfactory solutions for expropriated land users.

B. Presentation of BSSP’s Report on Environmental Impact Assessment

Mrs. Natalia Limankina, Consultant for Donaev Management Consulting, presented the main findings of the Environmental Impact Assessment (EIA) carried out for BSSP preparation.

Key points outlined by the expert with regard to EIA of the proposed project were the following:
1. Introductory part on key proposed project activities
2. Baseline data, current state and condition of the environment
3. Identified negative impacts
4. Mitigation measures, Environmental Management and Monitoring Plan

The project is expected to have positive long-term effects on the environment. While there will be damage to the environment during project implementation, it will be short-term and reversible. Mitigation measures for these negative effects are included in the project’s environmental management plan.

Discussion 2:

One workshop participant (Mr. Aripov) claimed that if all mitigations measures of the environmental management plan were implemented, this would be too much of a burden on the project budget. A prioritization of proposed measures is therefore necessary. The management plan should clearly indicate which measures will be implemented in practice and which will not.

Participants also presented their views regarding materials to be used for future sewer pipes in course of new construction and rehabilitation of existing ones. Basically, all of them came to an idea that modern plastic pipes will be reliable in terms of operation and finally for the environment.

Conclusion

Despite participants’ varying ideas and proposals on certain issues related to the (re)construction of the sewerage system, they all agreed that the current system had been causing a lot of environmental social, sanitary and medical problems for the population. Workshop participants were particularly concerned about the apparent threat that the current state of sewerage system may create to the unique constructions in the old historic part of the city. All participants therefore unanimously supported the project and thanked the World Bank for making funds available to the Uzbek government for its realization.
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<th>No</th>
<th>Name</th>
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<tr>
<td>1.</td>
<td>Khashimov Khakim</td>
<td>First deputy khokim of Bukhara</td>
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<td>2.</td>
<td>Safarov Akhrom</td>
<td>Resident of makhalla №4 (city’s historical part)</td>
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<td>3.</td>
<td>Rasvanov Dilmurod</td>
<td>Resident of makhalla №4 (city’s historical part)</td>
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<td>4.</td>
<td>Kudratov Asatullo</td>
<td>Association of journalists of Bukhara oblast (representative)</td>
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<td>5.</td>
<td>Khodjaev Bakhodir</td>
<td>Independent consultant of WB</td>
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<td>6.</td>
<td>Khaydarov Abdumalik</td>
<td>Bukhara hydrogeological station (head)</td>
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<td>7.</td>
<td>Davidov Najimiddin</td>
<td>Bukhara hydrogeological station (leading specialist)</td>
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<td>8.</td>
<td>Sidenenko Viktor</td>
<td>Bukhara TV&amp;radio company (editor)</td>
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<td>9.</td>
<td>Aripov Mumin</td>
<td>City of Bukhara (PIU)</td>
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<td>11.</td>
<td>Kazakov Aleksandr</td>
<td>Nature protection committee (inspector)</td>
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<td>12.</td>
<td>Astanov Rustam</td>
<td>City dept. of public education (head)</td>
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<td>13.</td>
<td>Kadiroev Akmal</td>
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<td>Kadirov Erkin</td>
<td>“ECOSAN” International organization</td>
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<td>15.</td>
<td>Simona Giger</td>
<td>WB expert</td>
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<td>Khudoyorov Ulugbek</td>
<td>Translator, WB specialist</td>
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<td>Ruziev Ziyodullo</td>
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<td>Saïdov Mansur</td>
<td>BVK “Suvokova”, representative</td>
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<td>19.</td>
<td>Ostonov Shokhimardon</td>
<td>BVK “Suvokova”, Head of network information systems department in the Institute</td>
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<td>Zakirov Ilyos</td>
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<td>Niyozov Khuseyn</td>
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<td>BVK “Suvokova”, Engineer</td>
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<td>Yudiev Bakhritdin</td>
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<td>Asadov Shomurod</td>
<td>Oblast state environmental expertise (Bukhara oblast)</td>
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<td>25.</td>
<td>Kurbanova Mavjudan</td>
<td>Chairman of makhalla committee №27 (multi-storey houses)</td>
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<td>26.</td>
<td>Rashidova Oliya</td>
<td>Acting chairman of “Makhalla” foundation</td>
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<td>Safarov Bakhtiyor</td>
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<td>Shodieva Dilbar</td>
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<td>I.Urinov</td>
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<td>Fattoev Gulom</td>
<td>Representative of Khokimiyat of the city on economic issues</td>
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<td>Muminov Rustam</td>
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<td>Tursunov Akhlor</td>
<td>Makhalla committee №7, Chairman</td>
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<td>Safarov Bakhtrom</td>
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<td>Mirzaeva Muborak</td>
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<td>Khamraev Bakhtiyor</td>
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<td>38.</td>
<td>Muminov Gullsum</td>
<td>Chairman of makhalla committee № 13 (city’s historical part)</td>
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<td>39.</td>
<td>Khaydarov Negmurod</td>
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<td>40.</td>
<td>Artikov Said</td>
<td>Resident of makhalla № 60 (private sector)</td>
</tr>
<tr>
<td>41.</td>
<td>Mukhamedov Orif</td>
<td>Resident of makhalla with multi-storey houses</td>
</tr>
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<td>42.</td>
<td>Aliyev Khaydar</td>
<td>Resident of makhalla with private houses</td>
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<td>43.</td>
<td>Akhmedov Ashur</td>
<td>Resident of makhalla with private houses</td>
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<td>44.</td>
<td>Kilichev Okil</td>
<td>Resident of makhalla with private houses</td>
</tr>
</tbody>
</table>
Information on Proposed BSSP Project and Announcement of Joint Public Discussion in the city of Bukhara (in Uzbek Language)

Date: 4 April 2009
Title of the Article: Sewerage System Renewed in Bukhara City
Source: Local newspaper “Bukhoronoma”
APPENDIX 4. LIST OF LITERATURE:

4. Regulation of the Cabinet of Ministers of the Republic of Uzbekistan “Regulation on water protected zones of water storage basins and other water reservoirs, main canals and collectors, sources of drinking water supply and domestic supply, medical and cultural health-improving prescription in the Republic of Uzbekistan” dated as of 07.04.92.
6. Sanitary rules and regulations of surface waters protection from pollutants (SanPIN №0056-96)
7. Generalized list of maximum admissible concentrations and approximately safe levels of harmful agent’s impact for water of fishery-purposed channels. Glavribvod, Moscow-1990.
13. Bogdanov O.P. Rare and endangered animals of Uzbekistan. Encyclopedia.- Tashkent: Main editor of encyclopedias, 1992.- page400
15. «Health protection in the Republic of Uzbekistan» statistical collection, Tashkent 1994;
17. «Environment condition and nature resources use in the Republic of Uzbekistan» statistical collection, Tashkent 2006
18. E.S. Pavlovskiy «Environmental and social role of protective afforestation on barren lands» Volgograd 1995;
20. Reports of State specialized inspection of analytical control (GosSIAK) of State Nature Protection Committee of the Republic of Uzbekistan.
24. Sanitary Epidemic Station 0025-94 Hygienic and sanitary technical requirements to sources of centralized household water supply. Selection rule.
25. KMK 2.04.03-97 Sewerage. External networks and facilities.
31. SanPIN №0057-96 «Assessment of scales of pollution of soils for various types of land use» T., 1996; -
32. SanPIN №0055-96 «Maximum admissible concentrations (MAC) and approximate-admissible concentrations of exogenous dangerous substances in soils» T., 1996.