E4642

REPUBLIC OF UZBEKISTAN

PAP-ANGREN RAILWAY PROJECT

ENVIRONMENTAL IMPACT ASSESSMENT

TASHKENT, 2014

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1.Introduction

Design and construction of a new electrified railway line Angren-Pap is carried out in accordance with the Decree of the President of the Republic Uzbekistan number PP-1985 dated 18 June 2013, by order of the Directorate of Capital Construction SJSCRC "Uzbekiston Temir Yollari" on the development of the feasibility study (FS) "Construction of a new electrified railway line Angren-Pap "(**Appendix 1**).

Environmental impact statement due to planned construction is carried out in accordance with the Law of the Republic of Uzbekistan "On Environmental Expert Evaluation" by the Regulation on State Environmental Expert Evaluation in the Republic of Uzbekistan, based on the conducted "Environmental Impact Assessment" and the report of the State Environmental Expertise on EIA, № 18/155z dated 26 February 2013 (**Appendix 2**).

According to the Appendix number 2 to the resolution of the Cabinet of Ministers of the Republic of Uzbekistan № 491 dated 31 December 2001 "On State Environmental Expert Evaluation", rail roads of republican importance are classified as having category I environmental impact (high risk), for which EIA is carried to the fullest extent.

This chapter constitutes the next stage of EIA procedure, and should be read jointly with the previously performed EIA statement.

According to the results of the State Environmental Expert Evaluation in the Environmental impact statement, it established the need for additional studies, research and development of environmental measures on the following issues:

- Development of measures on reinforcement of slopes and reclamation of vegetative ground cover in the disturbed areas during construction of the railway, to prevent the development of landslide processes and gullying during cutting of clay-loam soil along the route;

- Present detailed information on populated localities within the area of influence of railroad and propose measures to minimize the negative impact of the proposed activity on the local population;

- Develop effective measures for the protection of surface and groundwater from oil and household waste water pollution during the construction and operation of the railway;

- Perform an individual project on environmental impact assessment due to construction of bridges and channelization;

- Present detailed information on the locations of flora and fauna in reference to railroad

route and develop measures on conservation of biodiversity;

- Provide detailed information on hydrogeological conditions and the chemical composition of interstitial water, exposed during construction of the tunnels, on the basis of which propose measures on drainage, treatment and reutilization of water in a tunnel;
- Provide detailed information on the distribution of radioactive rocks along the route of the designed railway line and, if necessary, adjust the route to avoid opening of rocks enriched with radionuclides;
- Produce a detailed geotechnical studies report for development of protective measures in areas with landslides;
- Draft statement about the environmental impact due to construction of roadside borrow pits should be submitted separately in accordance with established procedure by law;
- It is necessary to provide local treatment facilities for utility sewage discharge st sidetracks and stations;
- To develop and submit environmental impact statement (the second stage) before approving the feasibility study in accordance with the established procedure by law;
- Performance of project land reclamation;
- Perform sanitary protection zone of the railway line in accordance with the established procedure by law;

During performance of environmental impact statement additional geodetic, geotechnical surveys, visual inspection of the territory and a detailed site plan included situational location of the facility. Includes additional requirements, based on the results of environmental impact statement draft review by the State Committee for Nature Protection.

For the development of the EIS specialized organizations were involved, such as:

- Central Hydro-meteorological Service under the Cabinet of Ministers of the Republic of Uzbekistan;
- State service for monitoring hazardous geological processes;
- JV LLC "UZROSNEFTEGAZGEO";
- Republican Centre for Gossanepidnadzor (State Sanitary and Epidemiological Surveillance);
- SE "Integrated geological survey and research expedition";
- Institute of the Gene Pool of Animals and Plants of Uzbekistan Academy of Science;

- StateBioControl of the Republic of Uzbekistan;
- Institute of Archaeology of Uzbekistan Academy of Science;
- Institute of Seismology of Uzbekistan Academy of Science;
- Central aerogeodesic enterprise;
- Institute «O ZGASHKLITI DUK»;
- Medical and sanitary service SJSRC "O'zbekiston Temir Yo'llari";
- Institute "UZDAVERLOYIKHA";
- Goskomzemgeodezkadastr of the Republic of Uzbekistan;
- SE "East Uzbekistan geological survey and research expedition"
- SE "Central Geological and Geophysical Expedition"

Mountain pass tunnel project through Kuramin range and impact assessment of the tunnel on the environment (Draft EIS) was performed by the Institute "Hydroproject". External power supply diagram of developed by institute "Sredazsetproekt".

Materials are stored in the archives of the Institute as non-reproductible part of the feasibility study.

2. Environmental features of the territory

The designed railway line Angren-Pap passes through Tashkent and Namangan regions and connects Ferghana Valley to the general railway network of Uzbekistan. The railway line crosses the Kuramin ridge that separates the Fergana and Chirchik-Angren intermontane basins.Route plan of the designed railway line is shown in **Appendix 3.**

Route of the designed railway line passes by a considerable distance follows river basins of Akhangaran (37 km), Chadak (51 km). After Koshminar station to station PAP (35 km) route of the railway line follows the Syrdarya Basin.

In geomorphological terms, designed railway route is conditionally divided into three sections: Angren - Sardana route is restricted to the river valley Akhangaran, characterized by relatively flat topography, many rivers and ephemeral streams; Sardana - Koshminar route restricted to the cross passage through the Kurama Ridge, characterized by high absolute elevations, large height difference; Sardana - Pap is represented as a piedmont plain on the right bank of the Syrdarya river with a low-angle slope, disturbed by adyr uplifts and stream flowing down from the Kuramin range.

2.1. Section Angren station - sidetrack number 1

Railway section Angren station - section Number 1, passes through a very complicated in terms of geological and environmental conditions through eastern industrial zone of Angren city

in the right bank of the river Akhangaran Route passes as a second rounte along the existing railway track of Angren coal mine in the direction Dzhigiristan station, further along the section in the direction of Akhangaran reservoir. On the right, above 4 km in length, comes the concrete enveloped Akhangaran river section (at a distance from the track at 150 to 50 m). Within PK 63-65, the route crosses the lower part of Naugarzan mountain creep, starting between the edge of Angren coal mine and earth dam of Akhangaran reservoir.

Environmental issues of this section should include a large man-made impact of the industrial zones and mines for land resources to atmospheric air and river Akhangaran. Hazardous geological processes include landslide caused by both natural and man-made causes. Following section are marked to have landslides: Zagasan-Atchinsk, Naugurzan, Open-pit side 2011 Verhnetursk.

Near the Angren city there is intense radioecological and geoecological situation, which occurred due to a combination of unfavorable natural conditions and man-made impact on the environment.

Akhangaran River while passing through the industrial zone Angren undergoes anthropogenic impact because it proceeds with wastewater pollutants. Water flows into the water protection zone from different industrial sites including large number of utilities, roads and railways (**Photograph 1, 2**).

2.2. Section sidetrack number 1 - station Sardala

On the 10th km with distance 1082 m route enters the right bank slope of river Akhangaran near the village of Chinar. Further the route follows in the easterly direction along the lower slope of the road A-373 Tashkent-Andijan. On the south side at a distance of 100-300 m (depending on the morphology of the slopes) passes the coastline of Akhangaran reservoir. In this area the route crosses a number of permanent and temporary streams flowing from the southern slopes of the ridge Chatkal. The largest of them Tangatapdysay and Chetsusay. Villages are located along the say such as Chinar, Terkakyrildy, Tangatapdy, Chetsu. Part of

River Akhangaran in the eastern industrial zone of city Angren.

Photograph 1.

Photograph 2

residential construction falls into the railway line affected zone.

Akhangaran river surface water storm flow starts in the area of Ayrisay (19 km of the route) before the formation of the Akhangaran reservoir. River valley narrows. In the area of sharp turns of the river Akhangaran and its floodplain, route repeatedly crosses the riverbed.

Partially the route passes over the left side of the valley and passes through the foot of the mountain slopes, represented as steep and cliffed rocky landforms with relative elevations of 200-400 m, with slope angle of 70-80 degrees or more, practically stripped of quaternary cover. Slopes are cut with valleys of branching network of permanent and temporary water flows. The largest of them Tashsay, Turvushinsay.

After Ertashsaya, railway line passes along the right bank of the mountain slope bottom parts up to the village Sardala with relatively subdued forms compared to the previous section. The major crossed stream flows Ertashsay, Beshkolsay.

2.2.1. Residential areas

Railway route runs through the territories of different land ownership and land users, partially affecting the residential areas. Settlements are mainly located on feeder of river Akhangaran. The largest of them include Chinar, Terkakyrildy, Tangatapdy, Chetsu, Koksaray, Mashinatop, Beshkul, Sardala. The presence of the road A-373 and settlements cause some difficulties in arrangement of the railway route in a fairly narrow river valley Akhangaran, subject to regulatory sanitary distance up to residential area. Railway route diagram in the vicinity of residential villages that are within the area of influence of the railway line, given in **Appendix 4**.

2.2.2. Water protection zones

Environmental feature of this section is defined by the Akhangaran Reservoir and mountainous part of the river valley Akhangaran. According to the "Regulations on water protection zones of reservoirs and other water bodies, rivers and main canals and water ponds, as well as sources of drinking and domestic water supply for medical, cultural and recreational purposes in the Republic of Uzbekistan", approved by Resolution of the Republic of Uzbekistan dated 07.04.1992 N 174, SHNK 2.07.01-03 "Urban development, planning and construction in areas of urban and rural settlements" around reservoirs and along rivers, must make provision for establishment of water protection zones and riverside strips. The width of the water protection zone of the Akhangaran reservoir with capacity of 0.25 km3 is set at 100 - 200 m. Width for Akhangaran river water protection zone varies for different areas, depending on the long-term average flow, with width of 100-300 m based on long-term average water level.

Water protection zone of the reservoir includes:

zone of predicted marginal erosion in 50 years (restricted area of new construction);

activite erosion zones, including hollows, ravines, gullies, coastal slopes and eroded land with steep slopes greater than 5 degrees, landslide areas immediately adjacent to the reservoirs;

zones of temporary flooding of land while retaining a forced water level in the reservoir;

zones of permanent land floods;

protective plantations along the banks of the reservoir.

Water protection zone of the river Akhangaran includes floodplains, areas of groundwater seepage, lands, flooded during high water and overflows, the first above flood-plain terraces, edge and steep slopes of valley walls, ravines, flowing directly into the river valley, landslide areas, coast areas prone to washing (processing). Railway line sections crossing the rivers and channelization areas given in **Appendix 5**.

Within the water protection zone coastal strip is shown, which strictly limits economic activities and prohibits construction of any industrial and civil buildings, residential housing, welfare and cultural facilities.

The minimum width of the coastal strip of Akhangaran reservoir is set depending on the types of adjacent land and steepness of slopes. On arable land, perennial plantings, and tree and shrub plantings, coastal strip shall be established if slope steepness above 3 degrees - up to 35 meters, 3 to 8 degrees - 35-40 meters. Upon slope steepness above 8 degrees, width of the coastal strip shall be determined on per individual case basis. In all cases, the coastal strip shall be established with a minimum width of 20 meters from the water's edge at normal headwater elevation level. In coast areas prone to marginal erosion, the minimum width of the coastal zone should be increased by the amount of the estimated shore retreat for 5-10 years.

The width of the coastal strip of rivers and sai shall be determined based on long-time average annual shoreline erosion and set depending on adjacent land and steep slope steepness of shores in the following sizes:

On arable land, perennial plantings, where coastal strip shall be established if slope steepness above 3 degrees - from 35 up to -55 meters and above 3 degrees - 55-100 meters.

hayfields and pastures where slope steepness is up to 3 degrees - 25-35 meters and above 3 degrees - 35-50 meters;

on forests lands and tree and shrub plantings where slope steepness is up to 3 degrees - 35-55 meters and above 3 degrees - 55-100 meters.

Maximum values are related to the most erodable soils.

Mountain rivers and dry sais with a temporary water flow, coastline strip width shall be determined based on individual per case basis, based on the nature of surrounding lands use and its impact on water condition.

Size of coastal strips of rivers and sais within populated locality shall be established on the basis of the specific conditions, by agreement with state environmental authorities and sanitary control agencies as well as architectural agencies and waste handling services.

The presence of a large Akhangaran river and its feeders to Akhangaran reservoir imposes its environmental restrictions on economic activity in area of railway route.

Existing economic use of the territory is often carried out without regard to the status of water protection zones and coastal strips of Akhangaran and feeders. This, primarily relates to residential construction and household farms, pasturage of livestock (**photographs 3, 4**). With violation of the status of water protection zones and road A-373. Fill slope of the road often pass over floodplain of Akhangaran river (**photographs 5 and 6**).

Construction and operation of the railway line within the water protection zones, coastal strips and especially in the channels and floodplains is associated with the risk of pollution and depletion of surface water and groundwater, which requires the adoption of effective measures to protect surface and groundwater from oil pollution, heavy metal ions and household waste water.

It is necessary to take into account that the upper part of the Akhangaran river valley is the area where main underground water reserves are formed for the Angren-Almalyk industrial hub.

Photograph 3. Residential construction of the village Koksaray in the water protection zone of the river Akhangaran

Photograph 4. Cattle grazing in a floodplains of Akhangaran river

Fill slope of the road A-373 in the floodplain of Akhangaran river

Photograph 5.

Photograph 6.

2.2.3. Cultural heritage sites

According to the Institute of Archaeology of Uzbekistan Academy of Science [1] area of the new railway route is rich with archaeological monuments of history and culture. Area of construction contains known 9 groups of monuments. During railway route survey in the section from Angren to the northern terminal of the tunnel, discovery was made of four groups of archaeological sites. Identified groups of archaeological sites are assigned with AK code. Three groups of archaeological site were identified in the site from the south terminal of the tunnel to the station Pap. Identified groups of archaeological sites were assigned with KP code. Location of archaeological sites along the route of a new railway line are given in **Appendix 6**.

According to the law "On protection and use of cultural heritage" special limiting regulation is established for protection of cultural heritage, such as: zone of protection of cultural heritage, development control zones and zones of protection of the natural landscape. Presence cultural heritage in the area of construction of the railway line necessitates preservation of historic monuments during construction.

2.3. Section station Sardala - station Koshminar

From the settlement Sardala the landscape is mountainous, split with absolute mountain peaks and dividing ranges from 1200 m to 2800 m. After Sardala station (35 km) railway line crosses the river Akhangaran enters the valley of the river Cuindy and from the right slope rises to the north portal of the tunnel pass on elevation level 1324 m. Maximum exceedance of mountain rock mass above the tunnel makes 1285 m.

On 58 km, the railway line leaves the tunnel pass entering the Sansalak valley, further to the Kaydaksay, Chadak valley river passes over steep slope on the right bank, descends in the direction of the Khanabad village and further enters the foothills of the Fergana Valley.

The southern slopes of the Kurama Range are one of the areas that feed the Fergana Valley. Populated locality are located mainly along Chadaksaya.

Geotechnical conditions of the tunnel pass area are characterized by possible presence of splits, fractured rocks, water saturation, possible increased radioactivity of rocks, seismicity.

The main tectonic structure of the site is the Dzhulaysay split that can be traced in a northwesterly direction far beyond the project area. When tunneling, it is assumed that the Dzhulaysay tectonic structure may be exposed, represented as a system of feathering fractures.

The main factor for soil moisture is the groundwater discharge which occurs due to fractures, small tectonic and shear cracks.

Northern slopes along the centerline of the Kurama Range at altitudes over 1,500 m are characterized by increased avalanche danger. Avalanche volumes reaches hundreds of thousands

of cubic meters, the average volume of avalanches makes 1-5 m3.

South-eastern slopes of the Kuramin Range, sloping down to the Fergana Valley, characterized by lower volume of rainfall, less thickness of snow cover, more flat landforms, which reduces the prpbability of avalanche danger.

Angren plateau territory, located in the headstream of the Akhangaran river and connecting Kuramin ridge with Chatkal is important for conservation of animals. Angren plateau is represented as a leveled surface of relict bottom of paleogene sea, raised over the past few million years to a height of 2500-3000 m. Tunnel of the railway line passes very close to the plateau of Angren.

2.4. Section station Koshminar – station Pap

From Koshminar station (87 km) the route enters the second terrace of the Chadak river, crosses the Chadak river, highway to Khanabad, moves along highway Namangan-Tashkent, crosses North Fergana Canal, descends to the first terrace of Syrdarya river and on the 119 km adjoins the station Pap. Pap Station is located on the 46th km of the existing railway line Kokand - Namangan.

The main part of the arable lands, gardens and vineyards are located in irrigated zones of Pap district of Namangan region.

Settlements are located mainly in irrigated areas more to the south from the Northern Fergana Canal.

On the 139 km, railway line crosses an ancient settlement Chilhudjra (KP-3). The ancient settlement is located 300 meters from the south-western border of the Pap city. Spread from the north-east to south-west and having a length of 400 m. Width of the preserved part makes 160 m, Territory of the ancient settlement, except the citadel, covered by modern Muslim cemetery.

Today the ancient city Chilhudjra is the oldest early city types monument throughout the North Fergana region. Ancient city Chilhudja is of of tremendous value for the study of the formation and development of the state and the process of urbanization in the Ferghana Valley.

2.5. Radiation environment

According to the letter of Goskomgeology of the Republic of Uzbekistan dated 17.09.2013 behind № 06-1709 (**Appendix 7**), river valleys Syrdarya and Akhangaran are generally characterized by low level of radioactivity 12-20 mR / h, corresponding to the normal natural background, typical for the region.

However, the mountain pass routes of the railway line and the adjacent territory has recorded increased level of radioactivity (25-40 mR / h) in volcanic rocks and intrusive rocks, reaching in some rocks 65-85 mR / h Specific effective activity of rocks exceeds 200 Bq/kg, which is

typical for all Chatkala-Kuramin region.

According to the data of gamma ray logging [2,3] in the well ZK-1 limit of gamma activity starts from 25 mc/hr to 36 mR/h. Well log of ZK-11 well, in general formed by complex rocks, gamma activity of which varies from 8 to 18 mR/hr. At intervals of 151,8-153,8m; 155,4-156,3m has increased gamma activity of rocks (28 - 22 mR/hr, where average background activity makes 16 mR/hr), which is restricted to the crush zone. Radioactive gamma ray anomalies are not identified.

When laying Kamchik road tunnel, finding was made of rocks with high concentrations of uranium mineralization, which created an intensity of gamma radiation EDR 900-1200 to mR/hr General background of petrographic species ranged from 15 to 70 mR/h, and in some cases up to 100 mR/h

Based on the general laws of distribution of uranium in the rocks of the region, and taking into account the mandatory presence of uranium-bearing zones of other natural radionuclides - radium and thorium, it is possible that the designed tunnel can pass through species, with high radioactivity level.

2.6. Hydrogeological conditions

Hydrogeological conditions described by surveys performed by the State Service of the Republic of Uzbekistan for monitoring hazardous geological processes [4] and JV "UZROSNEFTEGAZGEO" [5].

Hydrogeological conditions on the route of the railway line is divided into sections:

- river valley Akhangaran;
- mountain structure of mid part of Kuramin ridge;
- south-eastern slopes of the Kuramin Range;
- waste plains of south-eastern slopes of the Kurami Range.

The valley bottoms flowing down the slopes of Chatkal and Kuramin mountain ridge streams are filled with pebbles with thickness of 3-7 m. Groundwater lays in the depth of 0-10 m. Groundwater feed is due to interstitial water drainage of Paleozoic rocks and the infiltration of storm water. Water is fresh, with dissolved solids of 100-700 mg/l. Gravel permeability ratio ranges between 0.12-6.26 mm/sec, reaching in some areas 11.5 mm/s.

Alluvial aquifer system of Quaternary sediments is widespread in the Akhangaran valley river, presented by modern and upper quarternary gravel. Groundwater levels are located at a depth between 2-12 m, depending on the absolute height. Floodplain of Akhangaran aquifer system is represented as underflow stream. Water-bearing rocks are pebbles with thickness of up to 10-15 m. Groundwater plays an important role as a source of water and as a source of

irrigation. Salt load of groundwater mostly fresh with mineralization up to 0.5 g/l.

The middle part of the Kuramin range contain common fractured groundwater of volcanic-sedimentary strata and intrusive rocks. The zones of tectonic disturbances have occurrences of fractured-veined pressure water. The depth of formation thalwegs in the valleys 0-5 m, in dividing ranges 15-110 m. Groundwater fault zones are exposed at depths of 70-120 m or deeper. Thickness of crush zones reach 40-50 m. Thickness of the zone of regional rock jointing, according to exploration in the area of Chadakskoy group of mineral deposits, makes 50-70 m.

Zones of tectonic disturbances play a role of major reservoirs of groundwater. They are limited to springs with a flow rate between 1.2 to 10 l/s. Salt load of groundwater mostly fresh with mineralization up to 0.5 g/l. Springs are widely used for water supply at mining enterprises and irrigation in the river valleys.

On the south side of the Kuramin range, bulk groundwater begins to form in the pebble part of alluvial cones, preadyr absorption band of surface waters. Here they form the main flow of groundwater moving toward the center of the Fergana Valley. Pre-adyr part is characterized by deep bedding of the groundwater level (80-100 m). As the flow gradually approaches the ground surface. At the point of intersection of pebbles with fine grained soil, groundwater tapers out to superficial run-off. Groundwater has weak mineralization, that does not to exceed 1 g/l. Practically, all the water, even the largest feeds from Syrdarya in the Ferghana basin, after leaving the mountain area, actively used for irrigation for many centuries, their runoff does nor reach the Syrdarya.

After exiting the south portal of the tunnel, the railway route, according to the accident of the ground, located above the surface of the alluvial-proluvial plains of Almas-Chust-Varzin after-adyr cavity. The area haswidespread alluvial-proluvial aquifer system of quaternary deposits, represented by rudaceous material - glomeration on the sandy clay cement, gravel and boulders with thin interbedded silt and sand. Water-bearing rocks are pebbles. Fresh ground water.

From the station Koshminar (87 km) route passes over the surface of alluvial-proluvial plains merged evacuation cones of Chadaksaya, Kattasay, Muruldysay, Tuzlysay, Uygursay, Almassay. According to the hydrogeological zoning, site is confined to the area of distribution of fresh groundwater, products of evacuation cones of Fergana artesian basin. Aquifer system is represented by rudaceous material - gravel, pebbles and boulders with a thin interbedded silt and sand. Groundwater level at the depth of 14-94 m. Ground water is fresh.

2.7. Dangerous geological processes

Along the designed railway line, on the adjacent slopes and on the route itself, the State Service for monitoring hazardous geological processes have marked 12 sites of landslide-

avalanching processes with volume of more than 10 thousand. M3. The most dangerous geological processes are landslides and scree-avalanching processes. The period of snowmelt and heavy rainfall increases erosion flow works, water may cause mudflow hazards are possible. Common occurrence of landslide processes along the railway route is given in **Appendix 8.**

Complexity during the construction can be in areas of thick collapsible loesslike soils that require performance of preliminary anti-collapsing measures.

In accordance with KMK 2.01.03-96 "Construction in seismic areas" considered mountain part is related to the 9-point scale. Class of soil according to seismic properties - first.

Detailed description of dangerous geological processes are given in the "Report on the results of engineering-geological studies" performed by the State Service of the Republic of Uzbekistan for monitoring hazardous geological processes [4].

2.8. Flora and fauna

Feature of flora and fauna is given based on the research work "Characteristics of the flora and fauna of vertebrates and assessment of the possible impact on their status as a result of construction of a new electrified railway line Angren-Pap" performed by Institute of the Gene Pool of Animals and Plants of Uzbekistan Academy of Science [6] .

The railway route passes through different landscapes that include:

- foothills (adyrs);
- mountain zone;
- floodplain of mountain rivers;
- agricultural zone;
- industrial zone.

The flora

Foothills are represented by plains, rain-fed and irrigated lands, industrial zones and residential settlements. Lower parts of the slopes are covered with sagebrush and wildrye, higher - xerophytic shrubs, fescue plains.

Mountain areas are represented by mountain plains, mountain mixed forests, woodlands juniper light forests.

Floodplains are occupied with meadow and floodplain vegetation, floodplain forests, residential settlements.

The expansion of habitat types along the railway route, given in Table 2.1.

Table 2.1.

Route sites	Site types
1	2
km 0-9	Industrial zone
km 9-27	Developed Adyr belt in the bottom-lands of Akhangaran river
km 27-37	Mixed forest with rocky outcropping
km 37-40	Juniper light forest
km 40-60	Arid treeless mountains and rocks (on the sides of the say), further after the first stratum of juniper light forest
km 60-72	Arid treeless mountains and rocks. Say densely populated
km 72-87	Developed adyrs (gardens, pastures)
km 87-124	Developed land of adyr belt (pastures and development zone)

Belt of tree and shrub vegetation is mainly represented by juniper - evergreen tree of the cupressaceae line. The composition of slope type greenwood forests include: apple, pistachio, plum, maple, hawthorn, almond and others. Here is the essential part of floristic diversity of the area. Juniper stang are landscape vegetation type. Juniper forests, as a result of impact of anthropo-man-triggered and climatic factors, are the last stage of existence of tree and shrub vegetation of forest type. Juniper light forest and mixed forests are the most vulnerable habitats, as for the restoration of juniper requires considerable duration.

Bottom-land and floodplain forests are common in the valleys of mountain rivers. The so-called galley floodplain forests in the basin of Chadaksay are best reflected in the floodplain of the Sansalaksay middle reach (45 km -km 65). The main concern is the birchwood, located on the left bank of Sansalaksay, in the area of km 45 - km 50 of the railway line (above the tunnel). This formation is the only one on the Kuramin Ridge and listed as vanishing species. Birch forest of Chadaksay are in the list of unique plant facilities of the State Committee of Uzbekistan and the Committee for Nature Protection of Namangan.

According to the Institute of the Gene Pool of Animals and Plants of Uzbekistan Academy of Science [6] the considered region has expected sprouting of about 25 plant species included in the Red Book of the Republic of Uzbekistan. Among them chickpeas mogoltavicha, angren tick trefoil, crocus alatavicus, achoriphragma kuramense, Tulipa kaufmanniana, Tulipa vvedenskyi, Tulipa greigii, Tulipa bifloriformis, gypsophiloides, etc. The main part of the species of this group may grow between km 28 - km 90 in the area of juniper woodlands and adyrs of Namangan region. In adyrs, it is assumed the presence of populations of rare endemics of the Ferghana Valley - Acanthophyllum albidum and campanula lactiflora.

Half of the endangered species are found by single samples. They do not have sufficient capacity to reproduction and maintainability of the quantity in effective breeding population and cannot proliferate. Such species include tulip Tulipa vvedenskyi. It may be found on the right bank of Akhangaran river.

Fauna

The mammalian fauna is given based on the materials provided by the IInstitute of the Gene Pool of Animals and Plants of Uzbekistan Academy of Science [6] and in the assumed territory is represented by 27 species of 5 units. They include 2 species of insectivores, 7 species of carnivorous mammals, 3 species of hoofed mammals, 14 species of rodents, 1 species of lagomorphs. Features of distribution of mammals in habitats located in the immediate vicinity of the project area are given in **Appendix 9.** The category of rare and endangered mammals are of 3 classified types: Cuon alpinus, Spermophilus relictus, Marmota menzbieri.

Number of species of herpetofauna inhabiting at the assumed area consist of 26 species: two species of amphibians, one - turtles, 13 - lizards and 10 - snakes. Species composition, spatial distribution and conservation status of the herpetofauna of the project area is presented in **Appendix 10**. The maximum species diversity of reptiles represented in floodplains, in mountain villages and gardens and piedmont zone. Least of all reptiles in juniper woodlands and mixed forest with rocky ranges and rocky outcrops. List of reptiles of the project site with high conservation status is given in Table 2.2.

Table 2.2.

Name of species	Conservation status of species		
	Red Book of the Republic of Uzbekistan	Red Book of International Union for Conservation of Nature	CITES Convention Annexures
Среднеазиатская черепаха - *Agrionemys horsfieldi*		+	+
Панцирный гекконочик *Alsophylax loricatus loricatus*	+		
Круглоголовка Саид-Алиева *Phrynocephalus helioscopus saidalievi*	+		
Серый варан - *Varanus griseus*	+	+	+
Восточный удавчик - *Eryx tataricus*			+

Amphibians with high conservation status in the project area do not occur.

Deciduous forests are rich with starlings, orioles, blackbirds, woodpeckers, goldfinches, nightingales. In junipers are home for magpies, white-winged grosbeaks, finches, rock buntings. Rocks and steep slopes are nesting areas for glaucous pigeons, swifts, birds of prey: vulture, kestrel, gier eagle, golden eagle, and others. Block fields are a favorite place for chukars, snowcock.

The main habitats of birds, having critical significance for the species are nesting and feeding types. Territorial attachment occurs mainly in birds during the breeding season and during the winter. The highest species diversity was observed in forests, which grow various kinds of deciduous trees, including floodplain forest and rivers (67 species), and the deciduous (61 species) and the mixing forests (59 species). These habitats have a relatively good food supply, are well-covered and represent an opportunity for many species for nesting, arranging nests in trees and bushes. Minimum number of species and common for juniper light forests (31 species) and habitats represented by rocky outcrops and slope detritus (31 species). Similarly is the affluent composition of avifauna in mountain steppe (32 species). In-between positions are given to such habitats as mountain settlements and gardens (42 species), and the foothills represented with adirs (43 species).

Territory is inhabited by 9 species of birds included in the Red Book of Uzbekistan and 4 in the list of species threatened by extinction by IUCN (International Union for Conservation of Nature and Natural Resources). Distribution of rare and endangered species of birds in different habitats in the project area is presented in **Appendix 11**.

Located in the construction area water streams are in mountains and contain water of very high quality. They are inhabited by rheophilic species of fauna and flora, they are used to living in the crystal clear, cold water with very poor content of organic matter and planktonic food organisms. Rotifers and crustaceans are found in the dead-waters and in branches of middle and lower reaches. Infauna is represented by 64 forms, insects reach maximum diversity - 56 species (87.5%). Benthic fauna consists of oligochaetes and chironomids. Such ecosystems are usually highly sensitive to human impacts, especially during critical periods of growth and development.

Akhangaran river belongs to the first category of fishery ponds. The considered zone is most characterized by turkestan catfish, chars and schizothorax intermedius, alburnoides oblongus, luciobarbus capito conocephalus, zeravshan dace and gambusia [7]. List of fish inhabiting in the river systems in the area of influence of construction of a new railway line Angren-Pap is presented in **Appendix 12**.

Alburnoides oblongus, Snakehead, Glyptosternon reticulatum are included in the Red Book of the Republic of Uzbekistan. Cobitis melanoleuca is also included in the International Red Book. Endemics are Turkestan gudgeon and Nemachilus kuschakewitschi. List of fish living in the river systems in the area of construction of a new railway line Angren - Dad included in the Red Book of the Republic of Uzbekistan, the International Red Book and subject to special protection and special regulations of use are given in **Appendix 13**.

3. Ecological analysis of design solutions

According to the list of activities, based on which State Environmental Expert Evaluation shall be carried out (Appendix number 2 to the resolution of the Cabinet of Ministers of the Republic of Uzbekistan № 491 dated 31 December 2001 "On State Environmental Expert Evaluation", rail roads of republican importance are classified as having category I environmental impact (high risk), for which EIA is carried to the fullest extent. In accordance with the KMK 2.07.01-94 "Urban development, planning and construction of urban and rural settlements", designed railway line refers to the sanitary classification of class IV of production with established minimum distance from the residential area at 100 m.

Designed electrified railway line is a complex facility, which includes in addition to the railway line: railway tunnel with length of 19.1 km, by degree of difficulty related to the particularly complex and large facilities of national importance; high-voltage power transmission lines VL 110,220 kW (90 km), related to Category II impact on the environment; bridges and overpasses 39 units, with a total length of 4.4 km, with areas of straightening of river channels. During construction 50.6 million. м^3 volume of earthworks, including 34.7 million м^3 - drilling and blasting works shall be carried out. During development of the tunnel, 1.8 million. м^3 solid rock shall be excavation in the tunnel. As borrow pits of soil to the railroad tracks, soil shall be mainly delivered from the landforms rising above others, according to the longitudinal profile of the way. To supply the construction with the missing volumes of soil, borrow pits are designed along the route with total volume of 6.8 million. м^3. Planned to build 46 km of access and adjoining motor roads.

3.1. Land withdrawal and disturbance

This section is prepared based on materials provided by the institute "UZDAVERLOYIKHA" [8]. In the territory of Tashkent region from Angren station, the route passes along Angren coal mine with distance of 8.4 km, over other unused agricultural land (84 hectares). Further the route continues for 7 km through the territory of Akhangaran forestry (70 ha), of which 20 hectares are man-made forest and 50 hectares - others unused agricultural lands. Further the route continues over 19.8 km through the territory of the "Chatcal" massif (198 ha), of which 190 ha are occupied by pasture-lands, 8 hectares - other unused agricultural lands.

On the territory of the Namangan region the route runs through the territory of Abu Ali Ibn Sino massif (5 km). Lands are represented as pasturelands (50 ha). Further the route with length of 23.5 km passes through the "Chadak" massif. Lands are represented as pasture-lands (212 ha) and other used in agriculture lands (23 hectares). Then, the route passes through the territory of the "Vodiy" massif (20.5 km). Lands are represented as irrigated agricultural lands - 18.8

hectares, pastures-lands - 168 hectares, roads, irrigation canals - 0.4 ha, garden plots - 0.8 hectares, other unused agricultural land - 17 hectares. Further the route passes through the territory of the "Mashal" massif 9 km). Lands are represented as irrigated farmlands - 84.21 hectares, roads, irrigation canals - 2.6 hectares, garden plots - 3.45 ha. Further the route passes through the territory of "Mirsultanov" massif (4.2 km). Lands are represented as irrigated agricultural lands - 41.5 hectares, roads, irrigation canals - 0.9 ha. Further the route passes through the territory of "Dustlik" massif (0.0 km). Lands are represented as irrigated agricultural lands - 10.23 hectares, roads, irrigation canals - 0.27 ha.

The total length of the route (without tunnel) makes 98.4 km, the total area of land to be allocated - 985.2 hectares, of which 154.74 ha of irrigated agricultural land, 20 hectares of forests and forest plantations, 620 ha of pastures, 4.17 ha of roads, irrigation canals, 4.25 ha plots of land and 182 hectares of other unused agricultural lands.

The amount and composition of land seized for the needs of construction is given in Table 3.1.

Table 3.1.

Areas of permanent drainage, ga				**Areas of temporary drainage, ga**
Total	**including:**			
	plowland	**grassland pastureland**	**forest plantation**	
1	**2**	**3**	**4**	**5**
985.2	154.7	620.0	20.0	158.9

Permanent land allotment for the external power supply line is made by placing:

anchor steel supports - - 40 м^2;

intermediate steel supports - 30 м^2;

reinforced concrete supports - 13 м^2.

Sites for temporary acquisition of the land during the period of construction of power transmission lines include:

for anchor steel supports - 800 m2;

for intermediate steel supports - 550 m2;

for reinforced concrete supports - 250 m2;

right of way width - 10 m.

Specified areas for right of way make provision for possibility of wire and cable running-off operations and assembly of supports on erecting sites along the railway track lines.

154.7 hectares of irrigated lands shall be excluded from agricultural lands which would require execution of works for the conservation of topsoil (about 386 thousand. м^3), irrigation and development of new land equivalent in lieu of the construction.

As a result of mechanical impacts during the construction of the railway line, 985 hectares of

land will be disturbed. Land disturbance, except for acquisition for roadbed and other facilities include disturbance of vegetative ground cover on the surrounding land, formation of bald slopes, moulding boards. Such construction impact particularly effects the water protection zones, coastal strips and floodplains of watercourses due to crossings by the railway line.

For the construction of embankments, except for soil from excavations, provision is made for the establishment of roadside borrow pits for extraction of additional soil. Extraction of soil is associated with the disturbance of lands, destruction of soil and vegetation cover, habitats of animals and plants and relates to licensed activities requiring mandatory conduction of environmental impact assessment.

Disturbance and moreover destruction of soil and vegetation cover accelerates the exogenous processes, contribute to the development of mudflows, landslides and degradation of surrounding vegetation areas. Influence of man-made impacts the density of plantations, formation of light forest, low-yielding vegetative plant formation and derivatives of secondary community.

Passage of the approach line through agricultural lands can lead to accumulation of toxic elements in the soil, in vegetative articles of food, reducing their quality and productivity.

3.2. Populated localities

Residential settlements are located along the say and rivers, part of residential development which falls into the zone of influence of the railway construction. Certain environmental noise impact shall occur upon movement of trains. Sources of noise impact are moving trains (up to 78 dBA) and signals delivered by them (up to 90 ... 99 dB), loudspeaker station communication, industrial equipment. The main consequences of noise impacts on human is the noise annoyance, reducing auditory sensitivity, deterioration of speech intelligibility, sleep disturbance. Twenty-four-hour impact of rail noise considering its because of its discontinuity, unexpectedness of approach, especially in the evening or night hours, and sleep disturbance caused it may contribute to the development of neuroses.

Basic requirements for human habitat protection in their place of residence (residential area) set forth in SHNK 2.07.01-03 "Urban development, planning and construction in areas of urban and rural settlements", "sanitary norms SanPin of the Republic of Uzbekistan № 0246-08 «Sanitary norms and rules on protection of atmospheric air of populated areas of the Republic of Uzbekistan "SanPin Uzbekistan № 0267-09 "Sanitary rules and regulations to ensure the allowable noise level in residential and public buildings and in residential construction areas, "KMK 2.01.08-96" Protection against noise".

In accordance with the sanitary standards residential development must be separated from the railway by sanitary protection zone of a width of 100 m. When providing special noise

protection measures, the width of the sanitary protection zone may be reduced, but not closer than 50 m. Width of the sanitary protection zone to the garden-plots should be at least 50 m.

At least 50% of the sanitary protection zone must be landscaped.

Due to the significant impact influenced by the railway on the population living nearby, the design, it is necessary to provide effective measures to minimize the negative impact of the railway under construction on the local population.

3.3. Contamination of surface and groundwater

Based on designed service and technical buildings and facilities of the new railway line, it is expected to produce 41.7 thousand м^3/year of household waste and 1.2 thousand м^3/year of industrial wastewater. Consumption of water and sewage discharge at operation points are given in **Appendix 14**.

For sewage disposal at operation points, that do not have a centralized sewerage system, design makes provision for sewage treatment facilities. On traveling for the posts of EC provides septic tank and absorbing wells productivity 0.15-0.23 m3 / d. At the stations, Angren, Sardala, Koshminar and Pap 2 design makes provision for compact biological wastewater treatment facilities "Samarkand" with capacity of 1,5-36.0 м^3/day, with additional post-treatment on filtration fields. At stations Angren and Pap, connection can be made to the existing sewer networks. On locomotive and carriage platforms, ERP section line is designed, provided for the collection of industrial sewage for collection of oil and oily waste and treatment on oil catchers. Designed sewage facilities at operation points are shown in Table 3.2.

Table 3.2.

No.	Name of buildings and facilities at production sites	Number of buildings, units.								
		Name of operation points								
		st.Angren	Sidetrack 1	st.Sardala	Sidetrack 2	Sidetrack 3	st.Koshminar	Sidetrack 4	st.Pap 2	Total
1	2	3	4	5	6	7	8	9	10	11
1	Catchpit 60 м3	-	-	1	-	-	1	-	-	2
2	Sewerage pump station	1	-	1	-	-	1	-	2	5
3	Waste water treatment facilities									

4	Ceptic with catchpit 1,0 м³/day		-	1	-	1	1	-	1	-	4
5	Biological treatment unit 1,5 м³/day		-	-	-	-	-	-	-	1	1
6	same	3,0 м³/day	-	-	2	-	-	2	-	2	6
7	same	6,0 м³/day	-	-	3	-	-	3	-	2	8
8	same	12,0 м³/day	3	-	-	-	-	-	-	-	3
9	Filtration fields	1,5 м³/day	-	-	-	-	-	-	-	1	1
10	same	6,0 м³/day	-	-	1	-	-	1	-	3	5
11	same	18,0 м³/day	-	-	1	-	-	1	-	-	2
12	same	36,0 м³/day	1	-	-	-	-	-	-	-	1
13	Water and wastewater treatment facility for car wash but RISC		-	-	1	-	-	1	-	-	2

For designed facilities, sources of pollution of surface water and groundwater may be:

- surface contaminated rainwater from subgrade formation, territory for parking of rolling stock, vehicles, construction sites, groundwater drained from the tunnel;
- industrial and domestic wastewater from buildings, homes, passenger trains;
- emergency discharges, spills of oil-containing products, loss of cargo during transportation.

Estimated content of effluents are provided in the table. 3.3.

Table 3.3

Sources of pollution	**Suspended matter**	**Petroleum products**	**Biochemical oxygen demand**	**Chemical oxygen demand**	**Nitrogen ammonium salts**	**Phosphates**	**Chlorides**	**Surface-active material**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Industrial and domestic effluents of service and technical buildings and homes	200-500	-	300-550	-	30-40	15-20	50-60	5-10
Industrial waste water for service and technical buildings and structures	50-250	50-400	35-100	70-250	-	-	-	15-20
Stormwater runoffs	150	10-50	40-70	-	-	-	-	-

Upon tunneling, process water will be generated from drilling machines with increased concentration of suspended solids.

The railroad bed and adjacent land shall be polluted by losses of transported goods (loss of up to 10 t/km.annually) and wear products of rolling stock, railway tracks. Given the structure of the goods transported, in which the share of petroleum products is about 60%, may contaminate the subgrade surface and groundwater with oil leaks.

Atmospheric precipitation fall on the upper track structure and form surface runoffs polluted with oil products, phenols, ions of heavy metals, pesticides, fertilizers and other harmful substances. Storm wastewater from the railroad tracks contain [9]:

- oil products - 10-50 mg/l;
- suspended solids - 2-150 mg/L;
- heavy metal ions - to 5-10 MAC.

Under the present system, sewerage of passenger cars will be discharged on the railroad tracks up to 60 $м^3$/ km annually of household fecal waste from passenger trains. In addition to the liquid effluents, the passenger trains will produce up to 50 tons/year of solid waste. In this case, the railroad tracks and right of way will be contaminated with feces containing coliforms, helminth eggs.

Storm water from the upper structure of the track and the right-of-way are absorbed into the ground or diverted with longitudinal trenches or ditches in rectangular reinforced concrete pipes under the railway line, from where through lower terrain drain into the river or reservoir by bringing pollution along from the railway track.

Construction works and operation of the railway line within the water protection zones and coastal strips of Akhangaran reservoirs and river Akhangaran, mountain say can lead to contamination of surface and associated groundwater used for drinking water supply. The same can be caused by discharge of process and drainage water during construction of tunnels.

Environmental contamination by transported cargo, wastewater from designed facilities are especially dangerous in the mountain part of the route of the railway line, which is the region of formation of groundwater and surface water.

Location of sites of railway route sections in the coastal zone and the floodplain (see. **Appendix 5**) contributes to the spread of pollution in the waters of the river. At these sites, the railway line passes over the reserves of underground fresh water, stretching along the river bed Akhangaran. Ground waters are covered with pebble from top, therefore, practically not protected against the ingress of polusion from the track.

Construction sites designed for tunneling in the valleys of mountain rivers, mostly in their floodplain part. Platform are constructed in the form of embankments, where construction materials, concrete mixing plants, areas for construction equipment and inventory of fuels and lubricants, welding equipment, pump stations are located. Camp with corresponding

infrastructure, sanitation facilities and household facilities are located in the vicinity to the construction sites (**photograph 7-14**). Erection of sites leads to a change in the existing conditions of watercourses, leading to the inevitable cutting of floodplain forests and increases the probability of contamination of rivers by industrial and household waste, industrial and domestic waste water, fuels and lubricants.

The designed railway line relates to hazardous production facilities. Does not exclude the probability of accidents and emergency situations. Given that more than half of the goods transported are oil and oil products, it is most likely that accident during the transport will involve these dangerous goods. In case of accidents with oil spill, contamination of watercourses are highly probable along the railway line and in Akhangaran reservoir. Water may be contaminated with up to 60 tonnes of oil products.

Given that the railway line significantly affects mountain rivers, the habitat of aquatic shellfish and the source of high-quality fresh water, in the design solutions it is necessary to make provision for water protection measures. Construction of bridges and straightening of channels associated with the conversion of topography within the channels, must be preceded by assessment of the impact on the environment.

Photograph 7. Construction site at the northern portal of the tunnel in the floodplain of Kuindy river.

Photograph 8. Construction worker's camp next to the northern portal of the tunnel on the right watershed Kuindysay

Photograph 9. Storage site for construction, oil and lubricants materials on the shore of Kuindysay

Photograph 10. Reformed channel Kuindysay at the the northern portal of the tunnel

Photograph 11. Construction site with camp next to the second tunnel face in the floodplain of Sansalaksay

Photograph 12. Parking and refueling area for vehicles on the shore of Sansalaksaya at the tunnel face №2

Photograph 13. Construction work in the bed of Sansalaksay at the southern portal of the tunnel

Photograph 14. Construction worker's camp in the floodplain of Sansalaksay at the southern portal of the tunnel

3.4. Tunnel construction

The main impact on the environment at tunneling is related to violation of the landscape, land and land cover in the construction of portals, faces, construction sites, shift settlements, laying access roads, arrangement of surplus stockpiles of soil. During the construction of the tunnel fissure water can be opened. The approximate flow of drainage water from the tunnel could reach 1.2 thousand m^3 per day with a 1 km long tunnel .

Longitudinal profile of the tunnel with the following marks: at the entrance portal - 1322.92 m and at the outlet portal - 1463.99 m being designed as gable. This solution removes water from the tunnel coming to the roadhead flowing by gravity without artificial drainage devices.

Chance of opening by tunnel s or grooves enriched by rock radionuclides determines the possibility of formation of radioactive anomalies within which excess of health standards levels of gamma radiation and a total alpha activity of rocks will be present. In this case, radioactive gases, radon and thoron and their decay products can be released into the tunnel s air, in the amounts exceeding the standard ones. Problems may arise when disposing of rocks from tunnel ing.

In order to study the geological construction, preventing the opening of radionuclide enriched rocks in tunnel ing, in the areas of approaches to the North and South portals of the tunnel , SE "East-Uzbekistan geological survey search expedition" and SE "Central Geological and Geophysical Expedition" four wells were drilled: 80 m-depth ZK-1, 170 m depth ZK-2, 190 m depth ZK-11, 82 m depth ZK-12 [2,3].

The hydrogeological and geotechnical survey were produced in wells. The permeability coefficient and flow of groundwater were determined. Water samples were taken for reduced chemical analysis.

Borehole logging investigations were carried out. Gamma ray logging of apparent resistivity, caliper logging, directional survey were carried out.

According to the gamma-ray radioactive anomalies have not been identified in ZK-1 well; limit of gamma activity was from 26 mc / h to 41 mR / h - from 25 mR / h to 36 mR / h.

According the method of apparent resistivity (AR) the fractured rocks in ZK-1 well were separated at the following intervals: 23,5-24,0 m; 25,1-26,3 m; 40,6-42,0 m; 42,9-48,9 m; 60,8-62,2 m; 64,5-66,0 m; 66,9-68,5 m; 72,8-77,9 m; 78,8-80,0 m, in ZK-2 well at the following intervals: 35,0-49,9 m; 51,2-52,3 m; 53,7-63,4 m; 81,0-82,6 m; 96,1-112,2 m; 133,8-136,4 m 141,2-163,2 m.

The following was uncovered by ZK-11 well:

In 0.0 -9.8-m interval:

- Modern proluvial and alluvial deposits. Brownish-gray loam with rock fragments up to 10-20 cm. Felsic to intermediate volcanic units: felzites and dacites with glass wool groundmass, subvolcanic formations of similar composition.
- Brownish-gray loam with rock fragments up to 10-20 cm. Felsic to intermediate volcanic units: felzites and dacites with glass wool groundmass, subvolcanic formations of similar composition.

In 9.7 -190.0-m interval:

- alternation of lavas, tuffs, and tuffolavas and lava-breccia of andesite and andesite-dacite composition at the power of the individual phases from 1,4-8,7 m to 47,5-51,2 m and subhorizontal bedding. At the interval of 111,5-116,9 m tuff and andesite-dacite lava had been intruded by aplite dyke-like body of granite porphyry.

The following was uncovered by ZK-12 well:

In 0.0 -1,7 m interval :

Tuff breccia of sour-average composition of andesite-dacite. The massive material is significantly convulsed, being broken to small parts.

In 1,7 -82,0 m interval:

Alternation of lava-breccia, tuffolavas and lavas of andesite-dacite, andesite composiitons, being split by subconcordant body of fine-grained aphyric dacites in the interval 65.0-69.2 m.

Wells are practically «dry». Underground water flowing into the wells through cracks and in process of drilling later was not recorded.

Increased fracture in the zones of influence of the large-scale faults is the area of increased permeability, stretching out far deep in solid mass. According to the "Hydroproject JSC" [10] concerning the chemical composition of water, bicarbonate, calcium, fresh residue have the value of the dry residue from 0.15 to 0.35 g/l.

ZK-11 well column is generally compounded of rocks, which activity of gamma-gamma logging varies from 8 to 18 mR / hr. In the intervals of 151.8-153.8 m; 155.4-156.3 m there is increased gamma activity of massive material (28 - 22 mR / h on 16mkR / h background), which is due to the crushing area. Radioactive gamma-ray anomalies have not been identified.

As part of the geophysical survey radiometric geophysical work was carried out along the axial part of a planned tunnel . Survey bandwidth is 1.5 km. The length of the strip is 19,6 km.

As a result of work performed the following was set:

γ-activity of massive material in outcropping is 40-70 μR/hr;

- the points it can reach 100 μR/hr. All of these points are located on the side of the projection of the axis of the tunnel ;

γ- activity of massive material, overlaid by Quaternary deposits, is 15-30 μR/hr, which is close to normal background;

- comparison of stock materials and works performed indicates complete identity of γ – activity of massive material within the study site;

- separate points of increased γ – activity press upon to large-scale faults;

- on the basis of the work performed and the analysis of the stock material it was found that the values of γ--activity within the projection of the axis of the tunnel to the surface, do not exceed the normal value of the natural activity of the massive material of such a composition.

The situation may be complicated if further geotechnical studies confirm at tunneling the presence of background radiation in excess of maximum permissible level. In this case, there would occur the need to take protective measures against excessive radiation emanating from the heaps of underground workings.

3.5. Landslide and talus-landslip areas

During the construction of the railroad it is planned to make channels in the solid masses of loamy rocks that form the floodplain terraces and the sides of the valley of the river Akhangaran. Violation of land-cover and truncation arrays of clay rocks are associated with the risk of landslide processes and gully formation due to surface runoff. In this regard, it is required to develop measures securing slopes stabilization and revivifying of soil and vegetation cover in the areas being disturbed during construction.

In the area of Naugarzan landslide during the construction and operation of the railway there may occur base uplift of railroad groundwork, shift to the embankment of local landslides and devolution of rocky soil from the top of the cut slope.

When sinking cranks and hollows in the barrows seepage of groundwater in the soles of the

upland slopes is possible and, as a consequence, slumping or collapse of soil from the slopes. In conducting blasting operations rockfall talus in a kind of rockfall may be activated and the formation of new scree avalanchine sites in rock formations and landslides is possible in the areas covered by clayey soils which shall be considered during the blasting. The scope of blasting may be seen in the photographs (at development of a crank to the bridge over the river Akhangaran for 38 km (**photo 15,16**)).

Development of approach recess to the bridge through the river of Akhangaran for 38 km

Photo 15. Drilling-and-blasting.

Photo 16. Crank barrow.

3.6. Construction of bridges and straightening channels

At the intersections of the railway line with rivers, reservoirs and channels construction of bridges shall be provided. The schemes of bridges crossings are adopted based on the conditions of overlapping the mirror of water surface of rivers, deep mountain springs, passing of river discharge. Characteristics of bridges are given in **Annex 15**. In the areas of multiple crossing by the railway line route of the same bed, the project provides rectification of the channels. Channel straightening is performed during the construction of subgrade for the purpose of diversion of streamflow from the work area. After passing the nearest high water upon construction completion, a river bed shall take a new shape. As a result of construction change of natural landscape shall occur with the formation of a new ecological system (river floodplain - a railway line), which does not exclude the possibility of violations of the existing combinations of natural phenomena (biogeocenoses).

Implementation of construction work associated with the transformation of the relief within the channels, water protection zones and coastal strips affects hydrological parameters of watercourses and hydrogeological conditions of the territory. Therefore, when designing bridges, railroad groundworks within the channels and coastal strips, it is required to assess changes in these parameters on the environment.

3.7. Flora and fauna

Excavation and blasting during construction of the railway line may result to destruction of rare and endangered species of plants and plant communities in the zone of construction. This refers to tulips of Vvedenskiy (right bank of the Akhangaran river), populations of rare endemic of the Ferghana Valley: whitish smooth carline and halimoknemis with tomentose flowers (in adyrs of Namangan region). The main impact of the construction will be on juniper stand and floodplain forests. Expected effects may be exerted on the galley forests and floodplains in the middle stream line of Sansalaksay.

Violation of vegetation and natural terrain of the region may cause degradation or destruction of habitats occurring in those territories. To the greatest extent it will affect the nonmigratory and breeding species represented by mammals, reptiles, birds.

Construction of the tunnel will pass directly under the unique area of the Angren plateau, which is associated with long periods of heavy machinery operation, blasting in the construction of working platforms at the entry portals, working platforms at the three faces on the highway tunnel and approach roads. This will serve as a strong factor of concern for rare and unique systems. The scheme of entrances to the portals and advance heading is given in **Appendix 16**.

Land above the tunnel will be subject to the maximum direct and indirect impacts during construction - increase the level of noise, vibration, soil, dust content, increasing the number of vehicles and equipment, increased human contingent with all the ensuing consequences. All this has a very negative impact on the inhabitants of the plateau.

Taking into consideration the significant role of the Angren plateau for habitat and conservation of important components of the mammalian fauna of Uzbekistan, the fragility of alpine ecosystems characteristic of the area, as well as the uniqueness of the landscape, it can be concluded that the construction of a tunnel in the vicinity of this site will adversely affect the status of biodiversity.

All kinds of animals belonging to the amphibians and reptiles are sedentary. Therefore, earthwork, which caused damaged soil layer, are leading to their death. In egg-laying species, except the animals, their offspring dies out.

Comparison of disturbance coverage of habitat types and species diversity of birds shows that the main violations affect light juniper forests and arid treeless mountains and rocks. In these habitats 49 species of birds, or 34% of the species composition living in the project birds area were found. In this case, the habitats of 10 bird species would be violated with high conservation status, included in the Red Data Book and the international list of species threatened with extinction.

Construction of power lines in the conditions of the mountains, piedmont plains are dangerous to large birds, especially predators.

Construction of the railway line will have an impact on the fish fauna of the rivers affected by the production of excavation and blasting, construction of artificial structures, straightening beds of mountain streams and the work carried out in the floodplains. Effects include the following:

- mechanical and noise impacts (traffic, blasting, vibration, excavation etc.);
- pollution of surface and groundwater and soil due to contact of physically and chemically active substances with an aqueous environment (solid, liquid and gaseous wastes) of suspended material in the water erosion of disturbed areas;
- physical obstruction, destruction and countermeasures for the ways of seasonal, daily, and spawning (reproductive) migration of aquatic animals
- destruction of vegetation in floodplains in the field of bridges and cluttering-shore and riverbeds with debris.

Carrying construction and excavation work in the mainstream, floodplain and coastal parts of watercourses has multifactorial effects on aquatic organisms and fish fauna and, as a rule, makes significant changes to the existing system of environmental reservoirs, the effects of which may have an impact not only during the construction period, but within a few years after its

completion. During the works spot contamination and increased water turbidity inevitably arise and occur, extending downstream and gradually settling to the bottom, resulting in a reduction or elimination of natural biocenosis reservoirs.

During excavation, blasting and construction of bridges fluctuations in water level, reducing the flow of rivers, pollution may occur, which may lead to reduction of the number of spawning rivers and rivers suitable for natural reproduction of spawning areas, poor breeding conditions, reducing the range and abundance of fish populations.

During the operation the areas of the railway line passing in riparian zones of the river and Akhangaran reservoir will be exposed to noise and vibration impacts influencing on fish, water pollution which shall result to deterioration of fishery ponds.

4. The effectiveness of environmental protection measures

Since the construction of the project is carried out simultaneously with the designing, implementation of monitoring of compliance with environmental legislation is of great importance during the construction. This work shall be organized by the project implementation unit (PIU) with the involvement of the regional offices of the State Committee, State Biological Control, SSES, forestry, local government, "UZDAVERLOYIKHA institute " and other concerned organizations.

4.1. Preservation of Lands

For the purposes of management and conservation of land, preventing soil degradation processes, decreasing of unfavorable man-made and anthropogenic impacts during the construction of the railway line the project envisages the following:

- right-of-way under the railway track is designed at minimum required width;
- embankment subgrade shall be 65% backfilled by soils of the depressions by longitudinal movement of the soil in the easement area till the place of the mound. As a result, developing of by-route quarries reduced to 15.5 million m^3;
- decrease in the area of mechanical action on the ground through route optimization and limitation of movement of vehicles and construction machinery (traffic only in the right-of-way and access roads);
- to maintain the flow regime of groundwater and surface water, pass of irrigators and drainage collectors, under the railway and highways it is planned to construct culvert aqueduct;

– the construction project provides the deployment of building units in settlements or low value of farmlands taking into account maximum conservation of soil and vegetation;

– the cost estimate includes funds for irrigation and development of new equivalent lands in lieu of irrigated agricultural lands for the needs of non-farming. By reclamation it is planned to introduce 154.7 hectares of unproductive lands for agricultural use. According to the preliminary calculation of costs for carrying recultivation works, the cost of maintenance phase was 3.43 billion Soums, biological stage – 3.92 billion Soums. [8].

Key figures for land reclamation are shown in Table 4.1.

Table 4.1.

Indices	Unit of measurement	Value
1	**2**	**3**
Volume of topsoil removed	ths.m^3	386
Putting of unproductive lands into introduction	hectares	154.7
Gardening and landscaping service and technical buildings and homes	hectares	35
Reclamation of soil pits	hectares	250
Reclamation of soil dumps	hectares	476

On construction sites, where fertile layer is broken, prior to excavation stripping and storage of topsoil in temporary dumps is envisaged in order to maintain it for future use in revegetation.

Activities on land reclamation permit to save 386 m^3 of fertile soil for later use and enter into farmland 154.7 hectares of unproductive land.

As quarrying is related with impaired land and refers to licensed activities, quarry design is planned to be performed with environmental support and together with drafting of the EIS.

4.2. Living Conditions

In order to minimize the negative impact of the railway lines in areas, intended for building, the route of the railway line was laid, if possible, bypassing the settlements. Thus, due to the fact that the valley of Chadaksay is densely populated, the route of the railway line is laid up above along the right-bank hillside, allowing you to keep building settlements of Gulistan Altynkan, Chadak, Khanabad. In the densely populated Ferghana Valley railway line route is laid above the North Fergana Canal in non-irrigated and unpopulated areas bypassing settlements.

Arrangement of 100 m wide sanitary protection zone along the railway line, measured from the axis of the path, and planting of greenery shall provide noise reduction on residential areas from passing trains up to an acceptable level. Reducing the impact on the residential construction that falls within the sanitary protection zone of the railway road, and creation of conditions of

acoustic comfort is achieved by construction of noise barriers and strips of greenery. The Project arrangement and improvement of the sanitary protection zone will be developed within working project documentation.

For residential buildings falling within the sanitary protection zone of the railway line the size of SPZ shall be agreed in the prescribed manner with the sanitary-epidemiological service and the State Committee for Construction and Architecture. Where necessary, families are to be relocated.

In order to protect the population from the effects of the electric field and overhead power line design, construction and operation of the latter shall be carried out in strict accordance with the requirements of the Rules on design of power electric installations and Rules for protection of high-voltage electrical networks. For residential buildings, summer cottages along the power lines 10 m sanitary protection zone shall be organized in accordance with the requirements of the Rules of Electrical Facilities Maintenance. The level of electromagnetic radiation of power lines shall not exceed permissible levels.

4.3. Protection of surface and groundwater

Basic requirements for the protection of water facilities are stated in the law of the Republic of Uzbekistan "On Water and Water Use", sanitary norms SanPin Uzbekistan № 0172-04 «Hygienic requirements for the protection of surface waters in the territory of the Republic of Uzbekistan," in the Regulation "On the water protection zones", approved by the Cabinet of Ministers the Republic of Uzbekistan № 174 dated 07.04.1992.

When designing, constructing and commissioning industrial enterprises, buildings and other objects that may affect the condition of water and water bodies protection of waters from pollution should be ensured. Projects for the construction of enterprises, buildings and other facilities that may affect the condition of water and water bodies shall be agreed with the authorities of agriculture and water management, health surveillance and protection of nature.

Wastewater discharges into water bodies is allowed on the basis of permits for special use in cases where it may not lead to an increase in the water content of pollutants in excess of established standards and provided cleaning of water by users and consumers of wastewater to the limits set by the authorities for the protection of nature and health surveillance.

It is prohibited to discharge crude runoff from the industrial sites into water bodies.

In water protection zones of water reservoirs and other water bodies, rivers and mountain springs the following is prohibited:

- parking arrangement, refueling points of fuels and lubricants, maintenance and service places, washing and repair of motor vehicles and construction machinery;

- arrangement of sewage treatment plants and various types of sewage ponds;
- felling trees and bushes planted.

Within the coastal strips, in addition to the limits established for water protection zones, any kinds of construction are prohibited.

In accordance with the requirements of SanPin Uzbekistan № 0172-04 «Hygienic requirements for the protection of surface waters in the territory of the Republic of Uzbekistan" on the facilities exposed to accidents there should be developed emergency response plans, containing the procedures for emergency situations, the list of required hardware and decontaminating the emergency reserve reagents, the method of collecting, removing contaminants and decontamination of the area.

Prior to discharge to a watercourse it is necessary to provide the cleaning of storm water flowing from spans of bridges and railway approaches, located in the water protection zone.

During construction, it is necessary to provide for the cleaning of the surface runoff from parking areas of construction machinery. The areas of parking sites for construction machinery shall be organized outside the coastal strips.

Technological and drainage effluents generated during tunnel ing, before being discharged into mountain springs shall be treated. The terms of wastewater must be agreed with the territorial centers of State sanitary and epidemiological supervision SSES.

Cleaning of storm water from the railway line roadbed is a complex engineering task. Typical solutions are not available. Construction of treatment facilities capable of processing a large amount of atmospheric water in a short time is not profitable. Therefore, to prevent pollution of water bodies by rain the measures aimed at reducing the pollution of railway track by losses of transported goods, household waste at passenger trains shall be provided. A significant reduction in the concentration of storm water pollution can be achieved through systematic cleaning of the lane of railway line, periodic cutting and replacing the top layer of contaminated ballast.

Recently, the development of new protective technologies and materials is being carried out to allow us to solve the problem of cleaning rainwater flowing from the subgrade.

Since the composition and amount of pollutants that accumulate on the of the railway line bed is approximately indicative, it is necessary to conduct monitoring studies of the level of contamination of rainwater for developing methods for purifying rainwater flowing from the the railroad tracks.

Measures to prevent pollution of surface water and groundwater from the impact of the railway line shall provide the following:

- the highest possible observing a status of water protection zones of water facilities when designing the route of the railway line;

- operation of serviceable rolling stock with no signs of oil spills and spills of transported goods, the carriage of goods in a bagged form, the application of coatings precluding blowing bulk cargo from gondola cars and platforms, the use of passenger cars equipped with systems for collection fecal waste and household waste;
- maintenance of railroad tracks and turnouts, rolling stock in good condition to prevent accidents;
- systematic cleaning and replacement of contaminated ballast track structure
- recovery of the disturbed areas at the mountain springs upon completion of construction and complete disassembly of all auxiliary arrangement in the bed;

- elimination of pollution of watercourses by fuel, lubricants and other harmful substances when performing construction and installation works.

Protection of surface and groundwater from pollution by sewage from the service and technical buildings located at stations and sidings of the railway line shall be provided by the following:

- biological treatment of municipal and industrial effluents;
- non-admission of untreated wastewater from the service and technical buildings and homes into the water facilities or onto the land;
- sunk suction wells polluted for contaminated runoff, capacitors of sewage dispersal plant and treatment facilities, pit latrines shall be made with waterproof containers and the device for waterproofing interior surfaces.

For full biological treatment of domestic sewage and wastewater at the stations compact units prefabricated at "Samarkand" plant with performance of 1,5-36.0 m^3/d, with additional purification by filtration fields shall be used. Bioremediation is carried out by means of activated sludge. The installation consists of three interconnected chambers. The first chamber of the installation is divided into two processing zones. In the first zone (zone of settling) mechanical treatment (settling) of the solid fractions occurs. In the second zone (zone of the bioreactor) the water passes through the nozzle where it is cleaned of organic contaminants by brush clarifier due to biochemical oxidation. In a second chamber, which is the aeration tank, wastewater are exposed to fine bubble aeration. In the process of aeration the bulk of oxidizable pollutants is removed. In a third chamber tertiary treatment of sewage water from residual organic impurities and retention of suspended solids by a filter occurs. For disinfection of wastewater third chamber is provided with chloro-holder. From the third chamber purified water is supplied to the reservoir of purified water is used for irrigation or is supplied to the field for underground filtration into soil. The efficiency of the system provides a minimum of 95%. The scheme of compact setup is shown in **Annex17**.

When filling is completed it is required to make pumping of settlings and excess sludge from the plant using sewage trucks.

At the sidetracks domestic sewage effluent with the outlet to the septic tank is designed. Septic tank is a flow type sump in which both discharge liquid is clarified and precipitated residue is fermented. Detained suspended solids of organic structure when being subjected to anaerobic microorganisms are destroyed, turning into a gaseous substances and mineral compounds. Clarified water from the septic tank is coming into the chamber for disinfection, in which a chloro-chuck is put. Diagram shows a septic tank in Annex 18. Subsequnetly, treated wastewater enters a filter well for purification and filtration into the ground.

The filter well consists of a bottom filter, walls, floors, supply and ventilation pipes. Bottom filter is made in a form of gravel backfill with 15-30 mm particle size inside the well. Such a filling is provided at the outer wall surface at a width of 1 m. Well filter circuit is given in Annex**19**.

Phytomeliorative works, restoration of disturbed riparian forests and planting of windbreaks are of great importance for compensation of the negative impact of the railroad passage in water protection areas, foreshore and the beds of mountain rivers. Compliance with the above listed requirements will allow to reduce the level of pollution of surface water and groundwater to a relatively safe level.

4.4. Radiation Environment

As a result of drilling, laboratory, hydrogeological, geotechnical and geophysical surveys the possibility of tunneling was identified. Rocks forming the mountain range in the interval Angren-Pap allow to carry out the construction of the tunnel . Radiation-hygienic characteristics of rocks correspond to the parameters of civil engineering.

According to the letter issued by the State Geology Committee of Uzbekistan 17.09.2013, the № 06-1709 (**Appendix 7**), the construction of the tunnel must be accompanied by the following:

- daily measuring of exposure dose of gamma radiation (EDR, gamma radiation exposure dose rate);
- in every 100 meters of tunneling operation measuring of concentration of radon and its decay products in the air of the working area;
- in identifying rocks with elevated radioactivity assessment of the degree of danger and provision of their burial in the neutral ground;
- provision of effective ventilation system.

4.5. Geological Hazards

On the route of a new railway line the experts of the State Service for tracking hazardous geological processes carried out geotechnical studies [4]. The aim of this study was to identify and explore the areas of landslide and avalanchine processes, debris flow hazard, soil subsidence to develop appropriate protective measures. The main conclusions and recommendations concerning the results of the survey are presented in Annex **20**.

In accordance with the recommendations when passing through the landslide sections transferral of the route, cutting of landslide bodies, arrangement of elevated structures, increase of the artificial structure holes shall be provided for the passage of snowmelt and rainwater taking into account the possibility of removal of the landslide body.

The following recommendations were made in relation to Naugarzan soil slip to decrease landslide hazard:

1. Regular discharge of local landslides formed on the top of the cut slope, giving a slope a stable profile and cleaning from the top of the slope of unstable boulders and large fragments of rocks.

2. Trenching in the base of a cut slope for receiving debris that may fall from the top of the slope.

3. Construction of the drainage system in the base of upland slope all along landslide zone for interception and removal of groundwater.

4. Carrying a regular discharge of water from the lake in a place of waste coal mine, to reduce groundwater pressures and reduce their negative impact on the stability of the subgrade railroad line.

5. Preservation quarry face (lacustrine basin) as a natural drains accumulating groundwater of landslide solid mass.

6. On the lower slope of the railroad tracks to make dumping ground for the creation of the buttress in case of strains in the Jurassic deposits of kaolin clay which are potential areas of sliding of Naugarzan landslide.

During the construction and operation of the road it is necessary to provide a surface (underground) drainage at the site of stripping soil barrows of coal mine (7.1-9.6 km).

In order to protect the path from rockfalls on the fall-talus areas in the recesses, trimming the slopes by blasting, using rock-trapping trenches with the width from 3.0 m to 10.0 m and a depth from 0.6 m to 2.5 m depending on the depth of the recess and arrangement of side cuts with the width 5-10 m every 12 meters along the height of the recess shall be provided. The main purpose of trapping structures (trenches and shelves on the slopes) is to intercept (detention) of rock debris from the hill side of the bed and to prevent their fall onto the road.

During the period of construction and operation of the railway line permanent monitoring observations of the landslide-prone areas shall be planned and carried. Service tracking hazardous geological processes, developing recommendations on technology of construction work.

Service for tracking hazardous geological processes shall develop recommendations on technology of work management.

In conducting blasting operations, to ensure seismic safety, the maximum mass of the charge shall be determined by taking into account the distance from the blast site up to the protected facility. To reduce the seismic action and provide safety of workings sideboards protecting from windfalls and dangerous landslides project has adopted development of all the pits along the wells contour of preliminary presplitting. When carrying out blasting beside buildings their protection from damage by pieces of rock shall be carried out by hiding the surface of loosened cranks by metal grids and sandy or loamy soil in bags or bulk with the layer thickness of not less than 0.8 m.

Construction works and operation of the railway in strict accordance with the recommendations of the State Service for tracking hazardous geological processes will minimize the risks of environmental hazards on the railway line.

The actions aimed at stabilization of slopes and restoration of soil and vegetation in the areas disturbed during the construction of the railway play an important role for prevention of landslide processes and gullying. For said purpose it is planned by working documentation to implement the project of phytho-reclamation works and provision of tree and shrub shelter belts and green belts on the disturbed areas inclined to soil slip processes.

4.6. The tunnel under the main mountain range

It is planned to make a safe gallery within a tunnel under the main mountain range with exit directly to the outside for evacuation of people in case of fire and other emergencies.

The inlet and outlet sections of the railway tunnel provide extension of the main tunnel and the safety tunnel galleries of 100 m length to protect near-entrance sites of the tunnel from avalanches. Galleries shall be covered with soil with a slope from the bank to the mountain spring to provide a springboard effect at avalanching.

During the construction of tunnel s anticipatory cementation of tectonic fractures and their zones of influence shall be envisaged. In order to provide full coming into contact of tunnel finishes with the rock along the contour, it is envisaged to provide intrusion of sand-cement mortar. In the result of injections the construction surcharge of profile should be filled up, water resistance design shall be improved and created favorable conditions for the load accommodation of the

tunnel construction.

Internal shape of the bottom of the tunnel lining was set taking into account the need to accommodate drainage devices.

Concrete was adopted as the material for lining of the tunnel as the most suitable as meeting complex requirements to strength, hardiness, resistance to aggressive external and internal environment, fire and release toxic compounds in terms of construction and operation under normal and emergency temperatures.

Tunnel lining perceives growing confining pressure, protects the tunnel from groundwater and surrounding rocks from weathering. In the zones of tectonic disturbances of the mountain range it is projected to carry out implementation of rock grouting to the depth of 3 m.

Along the entire length of the main tunnel and the safety tunnel groundwater are intercepted by a belt and firing (local) drainage performed around the perimeter of the cross section with 3m step. Drainage represents transverse strips of rocks not covered by shotcrete, of which the bore holes have been radially drilled. On the bands filter material - bonded fabric is covered (for instance, glass wool), on top of a bonded fabric, along the perimeter and the entire length of the tunnel waterproofing material (geomembrane) is laid and all this is covered by permanent lining. Water coming from drill holes through the filter material flows into the tray, and collects in the pipe of the collecting system.

Safety tunnel plays also a role of a main drainage for the basic tunnel . Based on the hydrogeological conditions of the solid mass, the tunnel is located on the upstream side of filtration flow to fully capture the water from the water-bearing formation.

On the flooded areas of the main tunnel and the safety tunnel provided grouting around the workings shall be provided, which is to reduce the filtration characteristics of the enclosing rocks. In addition to cementing protection of tunnel s from groundwater is carried out using borehole drainage tunnel s drilled from safety tunnel and special drainage chambers.

The filtered water from around the underground complex is collected in a tunnel watersink and safety tunnel where closed drain collection header is arranged as a channel of rectangular cross section with 0,4 × 0,5 m dimensions. Water from the reservoir is discharged into closed mountain springs of tunnel near-entrance sites.

To ensure normal conditions of maintenance staff, train and repair crews constant exchange of air (ventilation) is provided which reduces the humidity in the tunnel, diluting harmful gases and removing excess heat.

Air supply to the tunnel is carried out through the ventilation tunnel by means of axial, two-stage main ventilation fans installed in the ventilation chambers located at the gantries. Air charging to the tunnel is made from the gantry towards the moving train by two fans each with a capacity of

130m^3/s, from the opposite gantry and exhaust fans remove the dead air.

4.7. Flora and fauna

Basic requirements to protection of flora and fauna are formulated in the Laws of the Republic of Uzbekistan "On the Protection and Use of Flora", "On protection and use of fauna", in the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan from 28.10.2004 № 508 "On strengthening control over sustainable use of biological resources. "Offers of the State Biological Control Committee of the Republic of Uzbekistan for Nature Protection (letter № 491-03 of 16.09.2013) with measures for conservation of biological diversity along the route of the projected railway line are given in Annex**21**.

During the construction the works shall be carried out with the greatest possible preservation of green space. Cutting of tree and shrub planting is permitted only by the public authorities' decision agreed with the State Committee of the Republic of Uzbekistan for Nature Protection. For cutting of tree and shrub plantings compensation payments shall be made.

To design solutions mitigating impacts on flora and fauna are as follows:

- on the site of the main clusters of populations of Red Book and rare species of flora and fauna railway line will pass in a tunnel length of 19.1 km length. Underground works maximally reduce the negative impact on surface soil cover, which is beneficial for preservation of vegetation;
- considerable length of railroad line runs parallel to A-373 and 125 highways on the areas which are already have been developed, which reduces the negative impact of construction works;
- River basin of Chad Aksay river, along which the railway is passing at considerable distance, is characterized by an increased role of secondary vegetation types, weeds, due to the current load on the pasture mountain pastures;
- rectangular culverts height of 2 m and more, with the holes of designed bridges, can be used by animals for crossing the railway track high embankments.

Upon completion of the railway line synanthropic species - lizard Nikolsky and fast, multi-colored and patterned snakes, as well as the water snake and toad, are capable to quickly raise numerosity, since there will be relatively comfortable space to arrange temporary hibernation burrows.

As conservation measures, except for wastewater and storm water, it is recommended:

- carrying out works in the channels in a short time during the drought period, with the least expenditure of water; restrict construction works in floodplains and river beds during the mass move and spawning (months: April-May);

- making a specific choice of location for construction of a bridge taking into consideration the value of the site for the reproduction of fish stocks for each transition of railway tracks line over streams;
- introducing the regime for the protection and monitoring of habitats of Tashkent pondweed bugs, Turkestan catfish, Turkestan currant tip borer and the Aral mudfish.

The main activities on mitigation of the negative impacts of the construction of the railway line passing through the foothill and mountain areas consist of afforestation of the adjacent hillsides prone to developing dangerous exogenous processes at the mountain slopes. Trees and shrubs render stabilizing effect on regulation of surface runoff, and is of great importance in the fight against erosion and debris flow processes. In this regard, as a part of the project it is planned to complete the project phytomeliorative works and tree and developing of shrub windbreaks on the sites of passing of the railway line in the bank-protection areas, riversides and floodplains of streams, in disturbed hillsides. It is necessary to use the accumulated experience of the Uzbek foresters on creation of shelterbelts and afforested mountain slopes (**Photo 17,18**).

Execution of s phytomeliorative works upon completion of construction, planting trees and shrubs and planting windbreaks on the sites of passing of the railway line in riparian zones, riversides and floodplains of waterways, land reclamation of disturbed construction (quarries, dumps, pits slopes, construction sites), will help to restore ecosystems disturbed by construction and will reduce the damage caused to the nature.

5. Conclusions and Offers

1. During the second phase of the EIA procedure - Statements on the Environmental Impact (EIS) geodetic surveying, engineering and geological surveys were conducted, a visual inspection of the territory was carried out and route plan of the railway line was designed for M1:2000 topographic surveying, including in the areas passing along the residential areas, in water protection zones and Akhangaran reservoir. The State Committee for Nature Protection took into consideration additional requirements based on the results of consideration of the Draft EIS. According to the results of additional studies, applied construction method and facility maintenance and operation, type of environmental measures aimed at prevention of negative consequences of projec implementation it is possible to conclude that implementation of the construction of a new railway line according to the decisions accepted in the draft shall not lead to irreversible crisis or changes in the environment during the construction and operation of the facility.

Photo 17. Afforestation of a hillside above OXANGARON reservoir

Photo 18. Experienced windbreaks near A-373road

2. In accordance with the Decree of the President of the Republic of Uzbekistan dated from June 18, 2013 № PP-1985, the construction of the railway line is being carried out simultaneously with the designing and development of operational and design estimates. Under these conditions part of environmental problems is solved simultaneously with the designing and constructing of the facility. In order to prevent and mitigate the adverse effects of the construction of a new railway line, together with further designing and constructing of the facility the following shall be provided:

- Forming a duly sanitary protection zone of the railway line. In the sections of the railway line passing through the residential areas, establishment of noise protection solutions shall be provided.
- Development of the project for reclamation of lands disturbed in process of construction (agricultural lands, quarries, dumps, construction sites), conservation and use of disturbed topsoil layer.
- Implementation of the Project of phytomeliorative works and tree and shrub windbreaks to prevent erosion and degradation of the vegetation along the route of a new railway line and at the areas of passing the railway line in the bank-protection zones, riversides and floodplains of streams to compensate for damage caused to biological resources by the construction works.
- The papers for allotment of lands shall provide compensatory payments for cutting down trees.
- Provision of measures to eliminate diversion of untreated storm water from the railway line into the water bodies. During the period of operation it is necessary to organize the monitoring studies of the level of contamination of storm water discharged from the railroad tracks located in water conservation zone zones.
- Execution of assessment of the environmental impact of construction of roadside quarries, bridges and sections of straightening channels under the framework of separate individual projects.
- Project implementation unit (PIU) shall organize monitoring of compliance with and observance of environmental law during construction with the involvement of the regional offices of the State Committee, State Biological Control, SSES, forestry, local government and other stakeholders.
- Provision of compliance with established quotas for emissions of pollutants into the air for the designed buildings and facilities.

Environmental activities in abduction of technological drains and drainage effluents resulting from the sinking and operation of the tunnel shall be provided by the independent-work

contractor on construction of a tunnel - China Railway Tunnel Group Co. Ltd. (People's Republic of China).

6. The list of completed research and studies used in this work

1. Report of the Institute of Archaeology of the Republic of Uzbekistan on the topic: "The archaeological exploration and research on “Angren-Pap" railway track. Samarkand, 2012.
2. Information report on the results of ZK-1 ZK-2 wells drilling during the construction of a new Angren-Pap electrified railway line on the site of approach area to the north portal of the tunnel. SE "East Uzbekistan geological surveying research expedition”, 2013.
3. Executive Summary on the results of drilling of ZK-11 ZK-12 wells from the South entrance of Angren-Pap new railway line. State Enterprise "Central Geological and Geophysical Expedition." Tashkent, 2013.
4. Report on the results of geotechnical studies for the feasibility study (FS) of "Construction of Angren - Dad electrified railway line" investment project. Public Service of the Republic of Uzbekistan for tracking hazardous geological processes, 2013.
5. Report on the hydrogeological conditions of water supply of separate points under Angren-Pap projected railway line. «UZROSNEFTEGAZGEO» LLC JV. Tashkent, 2013.
6. Report of the Institute of the gene pool of flora and fauna of the Uzbek Academy of Sciences on the topic: "Characteristics of the flora and fauna of vertebrates and assessment of the possible impact on their status as a result of construction of a new Angren-Pap electrified railway line”. Tashkent, 2012.
7. Report of the Institute of the gene pool of flora and fauna of the Uzbek Academy of Sciences on the topic: «Investigation of the effect of the proposed new Angren-Pap railway line on the fish of the affected rivers in the area of construction impact». Tashkent, 2012.
8. Materials of preliminary allotment of lands with the definition of the cost of expenses and revegetation according to version I of "Tracks of new Angren-Pap electrified railway" project at the stage of Railway Operating Rules. O’zbek Davlat yer tuzish ilmiy – loyihalash institute «O’ZDAVYERLOYIHA». Tashkent, 2012.
9. New technological solution to protect the environment within the railway rights-of-

way. Transport construction, 2012. № 7.

10. «Construction of Angren-Pap electrified railway line» Feasibility Study. Construction of a railway tunnel. Book 2. Structural and layout decisions and the draft statement on the impact on the environment (Draft EIS). "Hydroproject" JSC. Tashkent, 2013.

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Annex No.6

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Archaeological investigations and research

along the railway track Angren - Pap

Conclusion

During investigation of the railway line on the track section from Angren city to the tunnel northern portal four groups of archaeological sites have been discovered.

1. AK 1 is a mound necropolis. Coordinates of necropolis are: 41º03'71.8 '' N 070 º12'61.0 E.

(PK111, 660 m to the left of the railway track)

2. AK 2 is a burial mound. Coordinates of the burial mound are 41º 04'16.0 '' N 070º 13 '96.8''E.

(PK133, 248 m to the left of the railway track)

3. AK 3 is a burial mound. Coordinates of the mound are 41º 04'18.0 '' N 070º 13'96.0 '' E

(PK133, 311 m to the left of the track of the railway line)

4. AK 4 is Oktepa - Castle. Coordinates of the monument are: 41º08'89.6 N 070º25'29.1 E

(PK341, 890 m to the left of the railway track)

On the section area from the tunnel south portal to the Pap station 3 groups of archaeological sites have been discovered within the area of destruction.

1.KP 1. It is a mine opening - mine. Coordinates of the mine are: 41º03 '02,7'' N 070º 43' 09,8'' E.

(PK623, 215 m to the left of the railway track)

1. KP 2. There are 2 groups with 9 mounds. Coordinates of the group No.1 mounds:

Mound No.1 - 40º 51'27, 9'' N 070º 47' 32,9'' E (PK1095, 581 m to the left of the railway track);

Mound No.2 - 40º 51'15,9'' N 070º 47' 38,2'' E (PK1098, 312 m to the left of the railway track);

Mound No.3 - 40º 51'19,0'' N 070º47'36,3'' E (PK 1097, 376 m to the left of the railway track);

Mound No.4 - 40º 51 '14,2'' N 070º 47'39,4'' E (PK1088, 1158 m to the left of the railway track);

Coordinates of the group No.2 mounds:

Mound No.6 - 40º 51'20,63'' N 70° 47' 24,33'' E (PK1094, 290 m to the left of the railway track);

Mound No.7 - 40º 51 '18,17'' N 70º 47' 24,56'' E (PK1095, 224 m to the left of the railway track);

Mound No.8 - 40º 51 '16, 49'' N 70º 47' 24 87'' E (PK1095, 182 m to the left of the railway track);

Mound No.9 - 40º 51 '10,72'' N 70º 47' 25,68'' E (PK1096, 74 m to the left of the railway road).

3. KP - 3 is an ancient settlement Chilhudzhra and Upper Paleolithic location. Coordinates of the settlement are as follows

North-eastern point: 40º51 '02,23'' N 71º 06' 54'' E (PK1389, 121 m to the left from the railway road);

South-western point: 40º 50 '51,65'' N 71º 06' 41,53'' E (PK1387, 265 m to the right from the railway road).

All above mentioned archaeological sites were discovered and preliminary investigated for the first time. Materials about their location, cultural background, dating, scientific and cultural

value were sent to the State Committee for Protection of Monuments of the Republic of Uzbekistan and were included into the State Cadastre of tangible cultural heritage.

Partial or complete destruction of archaeological sites - exclusion of archaeological sites from the State Cadastre of tangible cultural heritage according to Article 11 of the Law of Uzbekistan "On protection and use of archaeological heritage" is performed only after its full final archaeological investigation.

Burial mounds within the area of destruction and buffer zone should be entirely investigated.

At the AK-1 site necropolis area 400 square meters shall be subject to excavations

At the AK-2 site 2 mounds with 10 m diameter and 1 m height should be investigated.

At the AK-3 site 3 mounds with 10 m diameter and 150 cm height should be examined.

At the AK-4 site its seems necessary to implement cutting of the wall in the north-eastern slope and excavation works on the "bastion" not affected by graves in order to identify functional purpose of the site, its system of fortifications and verify its date.

At the KP-1 site excavation works must be made in the mine on the area 40 square meters.

At the KP-2 site excavation works must be made at 5 mounds.

At the KP-3 site its seems necessary to perform 3 stratigraphical section in the northern parts of the Chilhudzhra settlement and excavation works on the Citadel that is not affected by graves in order to identify functional purpose of the site, its system of fortifications and verify its date.

All above mentioned scope of works may ne produce by expedition forces of the Institute of Archaeology at the Academy of Sciences of Uzbekistan within 6 months, starting in March 2013. Preliminary cost of archaeological works is 150 million UZS.

Project Manager: A.A Anarbaev

This is true:

Section Author: E.K Konovalov

Annex No.7

STATE COMMITTTEE OF THE REPUBLIC OF UZBEKISTAN

ON GEOLOGY AND MINERAL RESOURCES

Ref.No.06-1709

Date: 17.09.2013

Director

Main Design and Research Institute on Transport

JSC "Boshtransloyiha"

R.V.Ruziev

The National Environment Protection Committee (Goskomgeologia) has considered your letter № 08-61dated 28.08.2013 and informs on the following:

Projected route of the railway track Angren-Pap passes through the floodplain and the right river-side of the Akhangaran Valley in close proximity to the road Angren-Pungan. Northern portal of the tunnel is projected at the confluence of the Akhangaran and Kamchik rivers, southern portal in the Chadak river Valley. According to the available stock materials (Report on Comprehensive geological and ecological expedition "Assessment of radio ecological state of the Republic of Uzbekistan", 1997, executed by Makarov P.V, Semenov Y.S.), breaking up the rocks with high radioactivity during construction of roads unlikely shall represent a danger to builders and railway personnel.

Exposure dose rate of gamma radiation (EDR) on the surface of soil and rocks according to aero spectrometric mapping is 10-18 mR/h, which is the background for the country. Specific effective activity of rocks exceeds 200 Bq/kg, which is typical for entire Chatkal-Kurama region.

Execution of ground radiometric works on the ground surface in the area of projected railroad tracks shall not reveal significant radioactive anomalies. However, during performance of blasting on the surface and in tunneling excavation there may be breaking of rocks with high radioactivity. During designing of works location of these rocks and degree of its radioactivity cannot be determined.

During development of feasibility studies for construction of the tunnel in our opinion it is necessary to include the following issues in the scope of work:

- daily measurement of DER
- measure concentrations of radon and its decay products in the working area atmosphere in every 100m of the tunneling excavation
- provision of funds for additional concreting the tunnel walls to ensure reduction of radioactivity and ingress of radon into atmosphere from the rocks.
- after detection of rocks with high radioactivity it is necessary to envisage assessment of hazards and its burial by neutral soil;
- establishment of efficient ventilation system

Deputy Chairman: signature A.Mavlonov

Action by: Akhmedov M.Sh. Tel: 256-52-65

Annex 8

Prevalence of landslide processes

on the new electrified railway track "Angren – Pap"

1. Road section from Angren to the Dzhigiristan village

On the mountain slopes adjacent to the south side of the projected track for electrified railway there is Zagasan-Atchinsky landslide with a total volume 800 million cubic meters. Currently it is stabilized by buttress. Due to location at the significant distance it shall not effect on the projected railway road.

2. Road section from the Dzhigiristan village to the Chinar village.

On the mountain slopes adjacent to the south-east side of the road there is Naugarzan landslide with a volume 25 million cubic meters. At present it is in dynamic state. Subject to close proximity of the railway to the landslide area there is a possibility of its negative impact.

3. Road section from the Chinar village to the Ayrisay village.

On the mountain slopes, in the bottom part of which a projected track for electrified railway is envisaged there are such large landslides as:

- a landslide at the 120 km of the motor road Tashkent-Osh with a volume 1.5 million. cubic meters;
- a landslide at the 121.5 km of the motor road Tashkent-Osh with a volume 100 thousand cubic meters.

Currently these landslides are dynamic. Subject to crossing of these landslides zone by the railway track there is a possibility of its negative impact.

4. Road section from the Ayrisay to the Ertashsay.

Landslide processes have got unessential development. There are collapses, falling, rolling of stones, boulders and larger rock blocks on the cut rock formations at the A-373 road sections Tashkent-Osh as well as debris on the left side of the River Ahangaransay. Subject to man-caused impact on the mountain slopes within the rock masses there is a possibility for formation of new colluvial and landslide areas and intensification of the rockslide in the form of rock fall. There is also a possibility for formation of surface landslides on the mountain slopes in the areas covered by fine-grained material.

5. Road section from the Ertashsay to the Sardala village

Demonstrations of landslides have not been observed. Along the motor road A-373 Tashkent-Osh collapse, falling, rolling of stones, boulders and larger blocks of rock are being observed. Subject to man-made impact on the mountain slopes there is a possibility for formation of new colluvial and landslide areas in the rock formations and landslides on the surface area covered by clayey soils.

6. Sardala Station - northern portal.

Along the right side of the Kuinda stream there are areas where the depth of clay loam is up to 5m (39 - 40km). An old landslide with a volume up to 8 thousand m3 has been discovered in this section.

7. North Portal - south portal

In this section the railway track passes through tunnel under the Kurama Range (Davan city, Tashlak city and Tereklitau mountains) and comes out to the surface at the confluence of two streams of the River Sansalaksay.

8. South Portal – Pap Station

In this section no geological hazards development have been identified. In future during construction of the railway as a result of the steep cutting of slopes and blasting works there may be possibility for formation of potential landslide and falling areas and formation of collapsible deformation of soil on the loose areas.

Annex No.9

Distribution of mammals in habitats in the project area in the western Tien-Shan with their conservation status

Name of species and its conservations status	Types of habitats							
	Disparate areas of floodplain rivers	Settlements in floodplains	Adyrs	Sparse deciduous forest with rocky outcrops and areas of steppe elements	Mixed Forest	Juniper woodlands with rocky outcrops	Treeless, rocky slopes and cliffs	Alpine and subalpine meadows Angren plateau.
1	2	3	4	5	6	7	8	9
Insectivorous Order – *Insectivora*								
Eared hedgehog – *Hemiechinus auritus*		+	+					
Dwarf shrew – *Suncus etruscus*		+	+					
Vulturine Order – *Carnivora*								
Wolf – *Canis lupus*	+	+	+	+		+	+	
Fox - *Vulpes vulpes*	+	+	+	+		+	+	
Red dog – *Cuon alphinus* **(RL)**								+
Beech marten – *Martes foina*				+		+	+	
Turkestan weasel – *Mustela nevalis*	+	+	+	+		+	+	+
Marbled polycats – *Vormela peregusma* **(RL) Endemic subspecies**		+	+			+		+
Banger – *Meles meles*	+			+		+		
Cloven-hoofed Order - *Artiodactiles*								
Wild boar – *Sus scrofa*	+			+		+		
Siberian Roe Deer – *Capreolus pygargus*				+				
Siberian ibex – *Capra sibirica*						+	+	
Rodents Order –*Rodentia*								
Tien Shan souslik – *Spermophilus relictus* – Endimic			+			+		+
Menzbier's marmot – *Marmota menzbieri* (UzRDB RL) – endemic								+
Indian crested porcupine – *Hystrix indica*	+			+				
Forest dormouse – *Dryomys nitedula*	+			+				
Grey hamster – *Cricetulus migratorius*		+	+			+	+	+
Royle's mountain vole – *Alticola argentatus*				+		+	+	+
Juniper field vole – *Microtus carruthersi*						+		+

Name of species and its conservations status	Types of habitats							
	Disparate areas of floodplain rivers	Settlements in floodplains	Adyrs	Sparse deciduous forest with rocky outcrops and areas of steppe elements	Mixed Forest	Juniper woodlands with rocky outcrops	Treeless, rocky slopes and cliffs	Alpine and subalpine meadows Angren plateau.
1	2	3	4	5	6	7	8	9
Social vole – *Microtus socialis*			+					+
Kirghiz vole – *Microtus kirgisorum*			+	+				+
East mole vole – *Ellobius tancrei*		+	+	+		+		+
Red tailed gerbil – *Meriones Libicus*			+					
Pygmy wood mouse – *Sylvaemus uralensis*	+			+		+		
House mouse - *Mus musculus*		+	+					
Turkestan rat – *Ratus turkestanicus*	+	+	+	+		+		
Lagomorphs Order – Lagomorpha								
Tolai hare – *Lepus tolai*								
Total	**9**	**10**	**15**	**14**	**14**	**15**	**7**	**11**

Notes:

UzRDB – Types of mammals listed in the Red Book of the Republic of Uzbekistan

RL - Types of mammals listed in the World Red Book (IUNC – International Union for Conservation of Nature)

Annex No.10

Species composition, territorial distribution and conservation status of herpetofauna in the project area

Name of species	Abundance degree	Types of habitats								Use of species
		Rocky outlets, rocks and rock-slide	Juniper open forests	Mixed forest	Leaf bearing forest	Floodplain forest and river bed	Mountain steppe	Mountain settlements and forests	Foothill (adyrs)	
1	2	3	4	5	6	7	8	9	10	11
Amphibian Class *Anura*										
Pevtsova's frog – *Bufo pewzowi*	M	+	+	+	+	+		+	+	K
Lake frog – *Rana ridibunda*	M					+		+		K
Reptilia Class Tortoise Order – *Testudines*										
Central Asian tortoise *Agrinemus horsfieldi*	R								+	K
Lizards Order *Sauria*										
Shielded gecko *Alsophylax loricatus loricatus*	R					+		+		K
Gray Gecko *Mediodactylus russowi*	O					+		+		
Steppe agama *Trapelus sanguinolentus*	O								+	K
Said-Aliyev's Toad agama *Phynosephalus helioscopus saidalevi*	OR								+	
Gray monitor lizard *Varanus griseus*									+	
Glass lizard – *Pseudopus apodus*	R				+	+	+	+	+	K
Desert lidless skink *Ablepharus deserti*	M				+	+	+	+	+	
Rapid fringe-toed lizard – *Eremias velax*	O					+		+	+	
Kirghiz racerunner – Eremias nikolskii	O	+	+			+		+		
Snakes Order – *Serpentes*										
Tatary sand boa – *Eryx tataricus*	R						+		+	K
Dice snake - *Natrix tesellata*	O					+		+		K
Mountain racer – *Coluber ravergieri*	R			+	+	+		+	+	K
Diff racer – *Coluber rhodorchachis*	R	+	+				+			K

Dione snake *Elaphe dione*	R		+	+	+	+		+		K
Diadem snake – *Spalerosophis diadema*	OR						+		+	
steppe ribbon-snake – *Psammophis lineolatum*	O						+		+	

1	2	3	4	5	6	7	8	9	10	11
Central Asian viper - *Gloydius halys*	R	+	+	+	+	+				
Levantine viper – *Macrovipera lebetina*	OR					+		+		K
Total		**4**	**5**	**4**	**6**	**13**	**6**	**12**	**12**	**12**

Legend keys:

In column No.2: 'abundance degree': m – widespread specie: o- general; r – rare; or – very rare

In column 11: 'Practical use of species': K = commercial specie

Annex No.11

Distribution of rare and endangered species of birds

in different habitats of the project site

Names of specie	Conservation status		Type of habitats						
	Red Book of the Republic of Uzbekistan	IUCN Red List	Rocky outlets, rocks and rock-slide	Juniper open forests	Mixed forest	Leaf bearing forest	Floodplain forest	Mountain steppe	Foothill (adyrs)
Black Stork – *Ciconia nigra*	+		+				+		
Short-toed Eagle – *Circaetus galicus*	+			+	+	+		+	+
Booted eagle - *Hieraaetus pennatus*	+			+	+	+	+	+	
Golden eagle – *Aquila chrysaetus*	+		+					+	+
Bearded vulture - *Gypaetus Barbatus*	+		+		+			+	
Vulture – *Neophron perenopterus*			+					+	+
Black vulture - *Aegypius monachus*	+	+	+	+	+				
Griffon vulture – *Gyps fulvus*	+		+	+	+				
Saker falcon – *Falco cherrug*	+	+	+	+			+	+	+
Lesser Kestrel - *Falco naumanni*	+	+	+					+	+
Roller – *Coracias garrulous*		+						+	+
Total	**9**	**4**	**8**	**5**	**5**	**2**	**3**	**6**	**6**

Annex No. 12

The List of fish in the river systems in the area of construction impact of new railway track Angren - Pap *

Item	Name of family, species, subspecies	I	II	III	IV
	Cyprinidae family				
1.	*Alburnoides oblongus*	-	-	-	+
2.	*Alburnoides taeniatus*	-	+	+	+
3.	*Barbus capito conocephalus*	-	-	-	+
4.	*Gobio gobio lepidolaemus*	-	+	+	+
5.	*Leuciscus lehmanni*	-	-	-	+
6.	*Schizothorax intermedius*	+	+	+	+
	Cobitididae family				
7.	*Noemacheilus stoliczkai*	+	+	+	+
8.	*Noemacheilus kuschakewitschi*	+	+	+	+
9.	*Sabanejewia aurata aralensis*	-	+	+	+
	Sisoridae family				
10	*Glyptosternum reticulatum*	+	+	+	+
	Poeciliidae family				
11.	*Gambusia holbrooki*	-	-	-	+

* I – mountain flow zone of the Ahangaran river (with tributaries), II – Ahangaran water reservoir, III – Ahangaran river section below Ahangaran water reservoir; IV – upper section of piedmont flow zone; + – specie exists; - – specie does not exist.

Annex No. 13

The list of fish included into the Red Book of the Republic of Uzbekistan

Name of fish species (sibspecies)	**Categories of Threatened species[1]**
Backboned Type – Phylum Vertebrata	
Fish Superclass – Superclass Pisces	
Bony Fish Class – Class Osteichthyes	
Actinopterygian Sublass – Subclass Actinopterygii	
Carp-like fish Order – Order Cypriniformes	
Carp Family – Family Cyprinidae	
1. Tashkent bystranka	2
Alburnoides oblongus Bulgakov, 1923	
Carp-like fish Order – Order Cypriniformes	
Carp Family – Family – Family Cyprinidae	
2. Turkestan Barbel	2
Barbus capito conocephalus Kessler, 1872	
Loaches Family – Family Cobitididae	
3. The Aral spined loach	3
Sabanejewia aurata aralensis Kessler, 1877	
Catfish Order – Order Siluriformes	
Mountain Catfishes Family – Family Sisoridae	
4. Turkestan catfish	2
Glyptosternum reticulatum McClelland, 1842	

[1] – Category of threatened species

2. - Decreasing in numbers: taxa and populations with steadily decreasing population, which can quickly fall into the category of endangered species..

3.- Rare species: taxa and populations that are small in number and / or distributed in a limited area (water area) or sporadically distributed over large areas (water area).

The list of fish included into the World Red Book

1. Spined loach – *Sabanejewia aurata* (Filippi, 1865)

The list of fish subject to special protection and special regulation of use.

1. Turkestan Gudgeon (endemic) – *Gobio gobio lepidolaemus* Kessler, 1872

2. Zarafshan Dace (endemic) – *Leuciscus lehmanni* Brandt, 1852

3. Kushakevich's stone loach (endemic) – *Noemacheilus kuschakewitschi* Herzenstein, 1890.

Annex No 14

Water and effluent discharge by separate sites

№№ пп	Separate sites	Description of buildings, facilities, areas and structures	Water supple, m3/day			Water discharge, m3/day			Notes
			Drinking water consumption	**Industrial consumption**	**Total**	**Domestic effluents**	**Industrial effluents**	**Total**	
1	2	3	4	5	6	7	8	9	**10**
1	Angren station	Railway station for 75 passengers	4,080	0,240	4,320	4,080		4,080	**-** regular consumption with local cleaning at oil and grease collector
		Supply of passenger cars with water	288,000		288,000	2,880		2,880	
		Service points for cars with uncoupling repair point	5,050	2,184	7,234	5,050	0,960	6,010	
		Service points for power heads	6,570	6,900	13,470	5,340	0,200**	5,540	
		Modular boiler-house for power heads station		12,000	12,000			0,000	
		Rest home for locomotive crew with 24 beds	3,360	0,610	3,970	3,360		3,360	
		Fire department	1,970	0,120	2,090	1,970		1,970	
		Base for emergency train	5,671	3,020	8,691	5,671	1,820	7,491	

							(0,47**)		
		Base for fire engine train	5,671	3,020	8,691	5,671	1,820 (0,47**)	7,491	
		Operation base for signals and interlocking and communication facilities	0,075	0,120	0,195	0,075		0,075	
		Storage facility for instruments and warming up facility for 10 persons	0,250		0,250			0,000	
		Point of commercial check	0,425	0,312	0,737	0,425		0,425	
		Total in Angren station	**321,122**	**28,526**	**349,648**	**34,522**	**4,800**	**39,322**	
2	Uglesborochnaya station	Electric interlocking platform	0,150	0,480	0,630	0,150		0,150	
		Warming-up facility with toilet (2 units)	0,100		0,100			0,000	
		Total in Uglesborochaya station	**0,250**	**0,480**	**0,730**	**0,150**	**0,000**	**0,150**	
3	Switching track No.1	Electric interlocking platform	0,150	0,480	0,630	0,150		0,150	
		Low passengers platform	0,200		0,200			0,000	
		Warming-up facility with toilet (2 units)	0,100		0,100			0,000	
		Check-point for railway cars	0,080	0,072	0,152	0,080		0,080	
		Storage facility for instruments and warming up facility for 10 persons	0,250		0,250			0,000	

		Dwelling house for 2 flats (8 units)*	32,784		32,784				
		Total under Switching track No.1	**33,564**	**0,552**	**34,116**	**0,230**	**0,000**	**0,230**	
4	Sardala station Koshminar station	Electric interlocking platform	0,150	0,480	0,630	0,150		0,150	**- regular consumption with local cleaning at local treatment facilities ***- feeding of recycling water supply with fresh water
		Low passengers platform	0,400		0,400			0,000	
		Warming-up facility with toilet (2 units)	0,100		0,100			0,000	
		Control maintenance facilities for railway cars	4,800	0,270	5,070	4,800		4,800	
		Traction equipment	1,200		1,200	1,200		1,200	
		Alert center for distance overhead system	2,500	1,210	3,710	2,500	0,840	3,340	
		Storage facility for instruments and warming up facility for 10 persons	0,250		0,250			0,000	
		Distributor of railway section	4,165	1,080***	5,245	4,165	1,080**	5,245	
		Boiler-house for distributor		3,360	3,360			0,000	
		Campus for Paramilitary security service	9,062	0,200	9,262	8,762		8,762	
		Office building	6,520		6,520	6,520		6,520	
		Dwelling house for 2 flats (12шт.)*	49,176		49,176				
		Total under each Switching track	**78,323**	**3,240**	**81,563**	**28,097**	**1,920**	**30,017**	

5	Switching track No. 2	Electric interlocking platform	0,150	0,480	0,630	0,150		0,150	
	Switching track No. 3	Low passengers platform	0,200		0,200			0,000	
	Switching track No. 4	Warming-up facility with toilet (2 units)	0,100		0,100			0,000	
		Storage facility for instruments and warming up facility for 10 persons	0,250		0,250			0,000	
		Dwelling house for 2 flats (8шт.)*	32,784		32,784				
		Total under each Switching track	**33,484**	**0,480**	**33,964**	**0,150**	**0,000**	**0,150**	

6	Pap-2 station	Electric interlocking platform	0,150	0,480	0,630	0,150		0,150	
		Railway station for 75 passengers	4,080	0,240	4,320	4,080		4,080	
		Supply of passenger cars with water	288,000		288,000	2,880		2,880	
		Service points for cars with uncoupling repair point	5,050	2,184	7,234	5,050	0,960	6,010	
		Rest home for locomotive crew with 16 beds	2,240	0,430	2,670	2,400		2,400	
		Traction equipment	1,200		1,200	1,200		1,200	
		Alert center for distance overhead system	2,500	1,210	3,710	2,500	0,840	3,340	
		Storage facility for instruments and warming up facility for 10 persons	0,250		0,250			0,000	
		Operation base for signals and interlocking and communication facilities	0,075	0,120	0,195	0,075		0,075	
		Dwelling house for 2 flats (12 units)*	49,176		49,176				
		Total in Pap-2 Station	**352,721**	**4,664**	**357,385**	**18,335**	**1,800**	**20,135**	
7	Railway haul	Storage facility for instruments and warming up facility for 10 persons	1,750		1,750			0,000	Imported water supply from the nearest station of switching track
		Warming-up facility for 1-2 persons (including bridges)	2,250		2,250			0,000	
		Switching track attendant's facility	0,500		0,500			0,000	
		Guard post with enclosure for gods at the	1,260		1,260			0,000	

		tunnel							
		Guard post at bridges with surface facilities for safeguard zone	1,550		1,550			0,000	
		Total in railway hauls	**7,310**	**0,000**	**7,310**	**0,000**	**0,000**	**0,000**	
		Total by railway section	**972,065**	**42,142**	**1014,207**	**109,881**	**10,440**	**120,321**	

*- only water supply expenses are calculated under housing facilities

Annex No. 15

The List of Projected Bridges

Item	Stationing value (SV…+…)	Bridge type	Bridge Diagram	Length of bridge, m	Notes
Angren-Northern Portal Section					
1.	15+23	Railway Viaduct bridge	9.3+16.5+9.3	40.9	Reconstruction
2.	24+98	Railway Viaduct bridge	1x23.6	26.0	Reconstruction
3.	33+23	Railway Viaduct bridge	11.5+16.5+27.4+11.5	80.6	Reconstruction
4.	49+73	Tunnel type Railway Viaduct bridge	-	54.3	
5.	141+27	Overhead road	5x23.6	129.2	
6.	194+26	Concrete bridge	6x23.6	153.58	
7.	208+52.04	Concrete bridge	7x23.6	177.1	
8.	227+17.5	Concrete bridge	6x23.6	152.5	
9.	233+44	Concrete bridge	3x16.5	54.2	
10.	238+19	Concrete bridge	4x23.6+16.5	120.25	
11.	271+72	Concrete bridge	6x23.6	152.5	
12.	276+78	Concrete bridge	6x23.6	152.5	
13.	281+45	Concrete bridge	3x16.5	57.2	
14.	351+28	Railway Viaduct bridge	11.5+4x23.6+11.5	124.1	
15.	377+80	Concrete bridge	8x23.6	190.85	
Southern Portal – Pap Section					
16.	820+75	Railway Viaduct bridge	11.5+2x16.5+11.5	62.6	
17.	1094+68	Railway Viaduct bridge	11.5+2x23.6+11.5	86.8	
18.	1242+25	Concrete bridge	11.5+16.5+11.5	46.1	
19.	1245+90	Tunnel type Railway Viaduct bridge	-	60.4	
20.	1280+13	Concrete bridge	11.5+16.5+11.5	46.1	
21.	1292+57.2	Concrete bridge	11.5+23.6+11.5	53.2	
22-25	4 шт	Railway Viaduct bridges	1x23.6	26.0	Uglesborochnaya station

Annex No. 20

THE STATE COMMITTEE OF UZBEKISTAN

ON GEOLOGY AND MINERAL RESOURCES

THE STATE SERVICE OF THE REPUBLIC OF UZBEKISTAN

FOR KEEPING TRACK OF GEOLOGICAL DANGEROUS PROCESSES

APPROVED BY

Head

The State Service for keeping track of

Geological dangerous processes

_____ SH.K. Mirhadiev

"____" November 2013

CONCLUSION

of geotechnical examination for feasibility study (FS) of the investment Project

"Construction of the electrified railway track Angren - Pap"

Conclusions:

1. Directly along the projected railway track ancient landslide circuses are absent. They have been developed in the valleys of the right bank side tributaries of the Ahangaran River and do not affect the railroad.
2. Directly along the projected railway track large old and modern landslides constituting threat during construction and operation of the road have been developed between the 5th and 16th km of the track.
3. In other sections of the railway track in the field of low-power clay loam and skeletonless soil after cutting of the mountain slopes there may be formation of surface landslides in small volume.
4. In the construction areas of extended and deep recesses there may be displacement of relatively small landslides and collapse of friable fragmental material from the steep laid slopes.

5. In areas of the rock masses cutting during construction there may be formation of landslides and collapses of stone debris after blasting operations.
6. In areas of the embankments construction during road operation there may be development of collapsible deformation of soils until attainment of full consolidation condition.

Recommendations:

1. Regular unloading of local landslides and cracks formed on the upper slopes of the grooves and upland slopes with shaping sustainable profile of the slopes, as well as cleaning the top of the slopes from unstable boulders and rock debris.
2. Digging of trenches along the foundations of recess slopes and upland slopes for receiving of displaced landslide soil and debris from the top of the slope.
3. Construction of drainage system at the foundation of slopes with high embankments, deep excavations and upland slopes in areas of the groundwater discharge for its interception and removal.
4. Ensure the operating status of culverts under the railway engineering works.
5. Creation of the Control Systems for monitoring and danger warning:
   - to monitor thickness of the snow cover and intensity of rainfall;
   - equipment of springs and monitoring of the groundwater consumption;
   - creation of the geodetic network to assess dynamics of the deformations development at the landslide-prone areas;
   - to establish a system for remote control of the railway track territory for rapid identification of areas and local sections of deformations development (subsidence and uplifting) in the terrain by radar interferometry through using data of the periodic radar aerial photographs of the territory;
   - conducting of regime seismic measurements along the railway track to assess dynamic effects of the railway transport on the basement of railway track and stability of surrounding rock mass in terms of seasonal changes in rock properties.
6. Based on data of the Control System for monitoring and danger warning it is necessary to develop a scheme for anticipatory conditions of engineering objects of the railway to justify regime for railway traffic that does not allow development of dangerous deformations on the engineering objects and change of the surrounding slopes conditions.

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Annex No.21

STATE COMMITTEE OF THE REPUBLIC OF UZBEKISTAN FOR NATURE PROTECTION

STATE BIOLOGICAL CONTROL

Ref. No. 491-03 dated 16.09.2013

Proposals on measures for conservation of biological diversity

along the projected railway track "Angren-Pap"

Subject to Article 34 of Law of the Republic of Uzbekistan "On protection and use of animal world" during location, design and construction of settlements, enterprises, buildings and other facilities, improvement of existing and introduction of new technological processes, commercialization of the wetlands and bush occupied territories, land reclamation, forest use, geological exploration, mining and determining of locations for grazing and pass of farm animals, development of tourist routes and organization of places for public recreations it is necessary to arrange and implement activities for conservation of habitats and conditions of reproduction of animals and also provide integrity of areas with particular value as a wildlife habitat.

According to this Article at the end of construction works it is necessary to carry out activities on land reclamation along the railroad tracks.

Reclamation involves restoration of the landscape and natural communities. In simple words, it is required to restore the disturbed surface layer of the soil and plant the types of plants (plant communities) that were destroyed during construction works. Prior to start construction works on the road it is necessary to record biotypes. This work should be undertaken by biologists (Institute of the gene pool for flora and fauna at the Academy of Sciences of the Republic of Uzbekistan) and foresters (Department of Forest Management at the Ministry of Agriculture and Water Resources of the Republic of Uzbekistan), taking into account site-specific areas (with growing vegetation and wildlife inhabitants). After completion of work it is required to take measures for its restoration. To achieve establishment of plants means not only to plant, but also to ensure plants growing (watering and care).

According to the attached map-plans the track shall pass along the banks of rivers and streams. In this case it is prohibited to change water regime of the watercourses (drying or raising the level), which shall bring to change (destruction) of vegetation growing, its species composition, changes in the wildlife habitat and as a consequence to change (disappearance) of the species composition of animals.

Acting Head

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It's true:

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