

Environmental Impact Assessment

Project: ADB TA-9530 TAJ
July 2020

Central Asia Regional Economic Cooperation Corridors 2, 3, and 5 (Obigarm-Nurobod) Road Project

Volume 1 – Environmental Impact Assessment

(Volume 2 comprises Annexes to the EIA document)

FINAL

Prepared by the Ministry of Transport.

The Environmental Assessments contained in this document have been prepared based on the policy requirements of several International financial institutions who will fund the Project. However the reporting in this document follows the requirements of the ADB Safeguards Policy Statement (2009).

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REPUBLIC OF TAJIKISTAN



MINISTRY OF TRANSPORT




Looking towards Bridge #8 at Km36 (looking from Tunnel 2 north portal) (August 2018)



Snowfall, Kandak, Obigarm looking north. Alignment mid picture (November 2018)

**Environmental Impact Assessment
OBIGARM-NUROBOD ROAD
Dushanbe, July 2020**

Date	Notes	Created	Checked	Approved	Document code
1 Jul 2020	Final issue document	AJT			FINAL
Funding Agency  Asian Development Bank			Implementing Agency: Project Implementation Unit for Roads Rehabilitation Executing Agency: Ministry of Transport		

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ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
AIIB	Asian Infrastructure and Investment Bank
CAREC	Central Asia Regional Economic Cooperation
CEP	Committee for Environmental Protection
CIS	Commonwealth of Independent States
EA	Executing agency
EASM	Euro-Asian Council for Standardization, Methodology and Certification
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GRC	Grievance redress committee
GRM	Grievance redress mechanism
Ha	Hectare
IFI	International Financial Institution
LARP	Land Acquisition and Resettlement Plan
MOT	Ministry of Transport
NGO	Non-government organization
OESMP	Operational Environmental & Social Management Plan (EBRD document)
PIURR	Project Implementation Unit for Road Rehabilitation (of MoT)
PMC	Project Management Consultant
REA	Rapid Environmental Assessment
RoW	Right of way
SEMP	Site Specific Environmental Management Plan
SPS	Safeguard Policy Statement
TJS	Tajikistani Somoni (currency)
ToR	Terms of Reference
VOC	Volatile Organic Compounds
WB	World Bank

GLOSSARY

Hukumat	District administration in Tajikistan
Jamoat	A sub-district level administration
Land Acquisition	Refers to the process whereby an individual, household, firm or private institution is compelled by a public agency to alienate all or part of the land/assets for public purposes in return for in-kind replacement or compensation at replacement costs.
Land Acquisition and Resettlement Plan (LARP)	A time-bound action plan with budget setting out compensation for affected land/assets and resettlement strategies, objectives, entitlement, actions, responsibilities, monitoring and evaluation.
Non-titled	Means those who have no recognizable rights or claims to the land that they are occupying.
Resettlement	This includes all measures taken to mitigate all adverse impacts of the Project on DP's property and/or livelihood. It includes compensation, relocation (where relevant), and rehabilitation as needed.

The Project Implementation Unit for Road Rehabilitation (PIURR) of the Ministry of Transport (MoT) of Tajikistan is proposing to construct a replacement 76-km road for the M-41 in the mountain range to the north of the Vahdat River Valley. The new road (referred to as project) will include 3 new tunnels and 17 bridges, through a combination of: repairs, upgrades and the construction of new bridges.

An Environmental Impact Assessment (EIA) has been carried out for the project under the requirements of the Asian Development Bank (ADB) Safeguards Policy Statement (SPS) 2019, European Bank of Reconstruction and Development (EBRD) Environmental and Social Policy (ESP 2014) and Performance Requirements (PRs) and Tajikistan's environmental and social legislation and permitting procedure. ADB and EBRD have determined that the Project falls under Category A for environmental Safeguards that requires the production of an EIA document. For ADB the EIA document must be disclosed on the ADB website for a period of 120 days.

Project Description

The project comprises the replacement of the M41 road, part of the CAREC network (Corridors 2, 3 and 5) that will be inundated when the Roghun Dam is fully operational. The replacement road follows an alignment identified in the Soviet era that was partly constructed but not completed. Completed works included bulk earthworks, to establish the alignment, construction of three bridges and establishment work on two tunnel portals. There has been no further construction or maintenance work on the alignment since the Soviet era.

A design consultant has been appointed who has reviewed the original design, confirmed that the existing 76Km alignment is the most suitable replacement of existing road M-41 and identified modifications to bring the alignment upto current road safety design standards. These modifications will be constructed under three contract packages that split the alignment into two sections (west and east) and a separate contract to construct a "landmark" long bridge at the east end of the alignment. The redesign included adjustment of road curvature, modification of cut and embankment slopes, design for two tunnel sections and the addition of a third tunnel section, rehabilitation of three existing bridges, design for ten new bridges, a temporary bridge to cross the Vakhsh River at its eastern end, which will be replaced by a new long bridge as the third project component.

This EIA study covers Lots 1 and 2 from Obigarm to Nurobod, which are at an advanced stage of design. A separate assessment of Package 3 (long bridge) will be undertaken in the future when the design for this package has been prepared.

Alternatives

The "No Action" Alternative is defined as a decision not to undertake the proposed construction of the Project Road. The "No Action" alternative after inundation of the existing M-41 road corridor would remove all access for the existing 72,767 population¹ to the established towns of

¹ The population is derived from project district populations based on Districts' and Jamoats' statistics. See Table 3.1 (Population in Project Districts) LARP (Dec 2018)

Nurobod and Obigarm and wider Tajikistan road network Therefore a 'no project scenario' would have major social consequences.

An alignment was identified and partly constructed in the Soviet era, including bulk earthworks for cuttings and embankments, clearly establishing an alignment "on the ground". No other part of Tajikistan's national highway network can provide for the diversion of existing M41 traffic, and the only alternative route would represent a deviation of about 500 kilometers. Therefore, the environmental, economic and social impacts of constructing alternative alignments will be greater than the established alignment. However, refinements of the alignment were considered by the design engineer. A section (Km 29.5 to Km39.25) was identified where the road climbed to a high pass via a series of tight curves. It was concluded that from a road safety, cost and design perspective a 2.6Km tunnel section was more appropriate, reducing the alignment distance by 6.5Km and avoiding the high pass. This is the Tagikamar tunnel, a new tunnel on the alignment.

Existing Conditions

The project alignment runs west to east, broadly parallel to the existing alignment between 1 to 8km to the north, through upland / mountainous terrain. The area is sparsely populated with village developments confined to north south orientated river valleys that cross the alignment. There is no industry save for low intensity agriculture and the alignment is not regularly used by motorized vehicles due to its discontinuous aspect.

Site observations in August and September 2019 suggested that the environment along the alignment was effectively free from pollution sources (no noise or air polluting industry or fuel powered vehicle emissions). The only pollution source identified was localized wastewater discharges from human activities. A project specific environmental baseline was established and confirmed low levels of air, noise and water pollution. In addition a desktop study of ecological conditions and site walkthrough did not identify any rare or endangered species on or close to the alignment and there were no protected areas on or close to the alignment.

Key Environmental Impacts

General: The preliminary EIA findings are that all the potential adverse environmental impacts of the proposed final design can be prevented and/or mitigated adequately and positive impacts strengthened in the result of implementation of mitigation and enhancement measures identified in the Environmental Management Plan. Public consultations held in September 2018 identified clear beneficial social from the development of the project including access to medical facilities, markets, educational resources and increased opportunities for family visits.

Overall the proposed project is unlikely to cause significant adverse environmental impacts. This is due to the following findings:

- Most of the alignment will be rehabilitated within the footprint of an existing alignment constructed in the Soviet era.
- There are no sites of cultural or heritage significance within the area of influence of the alignment.
- There are no ecologically sensitive sites or protected areas falling within the alignment or its zone of influence
- The road realignments will remove tight bends, overstep hills sections and improve sight lines making vehicle movements more efficient than the existing M41 alignment potentially reducing vehicle emissions.

- The road improvements incorporate road safety elements within the alignment
- Where appropriate slopes will be cut back to more stable angles and incorporate landslip protection improving driver safety.
- Construction and operation of the project is likely to give rise to nil, negligible or at worst, minor temporary environmental impacts that can be easily mitigated to acceptable levels.

Construction Phase Environmental Impacts

Air Quality: During construction, air quality may be degraded by a range of operational activities including; exhaust emissions from construction machinery; open burning of waste materials; and dust generated from haul roads, unpaved roads, exposed soils, material stock-piles, etc. This can lead to health impacts to locals and impacts to ecology and crops.

Soils: Potential soil contamination is a possibility in the construction phase resulting from poor management of fuel, oil and other hazardous liquids used during the project works. Without adequate protection measures soil erosion could occur on road and bridge embankments.

Surface Water: Impacts to surface water and groundwater could occur through improper operation of construction camps and associated manufacturing areas including crushing and grading, concrete and, asphalt production. Poor construction management around bridges and close to surface watercourses could also lead to pollution incidents. Technical water can be sourced from rivers in the Project area without impacting on existing inhabitants.

Biodiversity – Desktop studies and site walkovers have been carried out to assess the impact of the project on biodiversity. The alignment itself will be constructed on land heavily modified to create an alignment in the soviet era and surrounding areas exhibit human influence (modification) due to harvesting of hillsides for cattle fodder, grazing of cattle and tree clearance. Faunal species of conservation concern are likely to exist within the project area but will vary through year due to weather conditions and livestock movements. Seven rare and endangered plant species listed in the Red Book of the Republic of Tajikistan grow in the project area but outside the immediate project footprint on the slopes of ridges, scree, in the steppe or meadow zones. No protected areas are situated within the zone of influence of the project, the closest is Romit State Nature Reserve, which lies c. 25km to the north-west of the project. Mitigation for biodiversity impacts in the heavily modified alignment will include avoidance when encountered and worker education on protection through preventing hunting, poaching and collecting of rare seeds.

Groundwater – Impacts to groundwater include spills and leaks of hazardous liquids used at construction sites and camps and potential impacts to groundwater resources during tunnel construction. Mitigation will be through good site practices implemented by the contractor and checked during periodic audit. Specific mitigation includes forming bunds to guide unpolluted water around works areas, silt traps and bunds downstream of site and sumps for settlement before discharge, drip traps and good maintenance of equipment.

Natural Hazards – The alignment is located in a region that is seismically active and the road and associated structures have been designed in accordance with the appropriate design standards. The alignment is susceptible to landslides, mudflows and floods but the design includes provision for a drainage system that has sufficient capacity for intense rainfall events, the road is protected against slope instabilities and surfacing materials are appropriate for the conditions expected. At construction site level, the contractor will prepare a Slope Stabilisation Plan and Water Resources Management Plan to prevent construction activities increasing flood risk.

Bridge Construction - Bridge construction activities may increase silt load in the river during construction at bridge sites and could include accidental spillage of concrete and liquid waste

into rivers. This could impact upon the ecology of rivers and aquatic wildlife, though it is recorded that there will be very limited work in the stream bed and existing flows will not be impeded.

Spoil Material: Since bulk excavation was completed in the Soviet era, spoil management is of reduced concern but there is still potential for impact as there will be project related slop cutting embankment repair and tunnel spoil to be dealt with. Estimates provided by the Design Engineer indicate an excess of around 0.5 Mm³ of soft spoil works and around 4.5Mm³ of rock from tunnels. It is believed that much of the rock can be reused in the manufacture of road base and in the asphalt layers. Design Consultant has investigated suitable locations for disposal sites on the alignment to accommodate excess spoil. The Contractor may choose to use other sites but these will be subject to approval following environmental investigation.

Tunnel Construction - Tunnel Construction - The main concerns linked to underground works are triggering of surface settlements, structure collapse and slope instabilities, drying of springs and groundwater alterations, and environmental concerns due to storage and use of excavated materials, noise, vibration and pollution of groundwater. It is noted that for this project that the three tunnel locations are in extremely remote locations. There are no villages that use spring sources close to tunnels and no impact on the existing water supply is anticipated. There are only 14 structures within 500m and > 150 within 1000m of the tunnel portals and impacts on sensitive uses are not anticipated. A blast vibration model (using conservative assumptions) concluded that structural damage may be experienced within 60m of the tunnel portal but no structural damage was likely beyond 130m of the tunnel portal. All structures are more than 130m from tunnel portals.

Construction Camps - Construction camps are a temporary land use change with potential impacts on air quality (dust); water quality (poor sanitation) and improper solid wastes and effluent; together with issues related to unwanted construction worker fraternisation (cultural differences, HIV / AIDS, etc.)

Access Roads – Temporary access roads will be required by the contractor to reach the alignment from existing road M41 during the construction phase. In the study two potential access roads were identified in Lot 1 and four in Lot 2. These Contractor access roads are existing village access roads and the Contractor will be responsible for maintaining / enhancing the existing road to allow passage of construction vehicles to ensure that construction activity does not compromise road safety or adversely impact the environmental conditions for residents alongside the alignment. Ultimately the existing road M41 will cease to exist and villages will need to be connected “uphill” to the new alignment on **permanent access roads**. These permanent access roads are essentially an upgrade of existing roads, no new access road construction is proposed. There are 11 permanent access upgrades (30.25Km) in Lot 1 and 14 (44.8Km) in Lot 2.

Physical and Cultural Resources – Physical cultural resources within the Project area are set back from the Project road and are unlikely to be impacted during construction. While unlikely a chance find process is included for any objects or relics uncovered during excavation work.

Operation Phase Environmental Impacts

Air Quality – The main source of air pollution during the operational phase will be from vehicles moving on the highway. The main pollutants are: CO; NO_x; hydrocarbons (HC); SO₂; carbon dioxide (CO₂); and particulate matter (PM). A dedicated quantitative modelling exercise has been carried out. Modelling concluded that due to the low traffic volumes upto 2033 the resulting emissions are well below the applied legal requirements and therefore no additional measures

are needed for air pollution protection” i.e The modelling quantitatively determined that traffic on the alignment will not have any significant impact on the air quality environment.

Traffic Noise – A dedicated 3D noise model was developed for this EIA to determine the noise levels on the alignment at 2018 (baseline), 2025 (7 years from the base year) and 2033 (15 years from the base year). The results of the model showed that traffic noise levels at some sensitive receptors exceed the desirable night-time level 45 dB(A) for the 2033 reference year². It should be noted that the increase in the noise level from the base year 2018 to the reference year 2025 will be less than 3 dB(A). The model was rerun incorporating 23Km of 4 to 5m high acoustic barriers at sensitive locations. With this mitigation in place it was possible to achieve the night-time criteria at year 2033. Therefore, no noise physical mitigation measures are considered at project opening upto year 2025 but the situation shall be monitored and mitigation planned when noise limits are approached. This is appropriate due to uncertainties involved with predicted traffic volumes beyond 2025 upto 2033 As an alternative to noise barriers mitigation could consider reducing speeds through villages (a 30km/hr limit could reduce noise level by 2.7dB(A)) or a night time ban on trucks could reduce noise level by 7.1 dB(A).

Mitigation and Management Actions

Design, construction and operation phase management plans have been derived and presented in a set of site specific Environmental Management Plans. The EIA document includes these Environmental Management Plans (EMP) identifying (i) mitigation measures for potential environmental impacts encountered during implementation, (ii) an environmental monitoring program to ensure that mitigation is in place and operating effectively; and (iii) identification of the responsible entities for mitigation, monitoring, and reporting. The Construction phase EMP will be included in Project Bidding Documents for the project for adoption by the Contractors, though it will be a contract requirement that the Construction Contractor will be required to develop and gain approval for their own site and construction methodology specific Site Specific Environmental Management Plan (SEMP).

Stakeholder Engagement

During the Due Diligence process for the project (August and September 2018) the Consultants and the Project Implementation Unit for Road Rehabilitation (PIURR) conducted 6 consultations along the alignment with the Affected Households and wider communities, 7 consultations in Hukumats and Jamoats authorities, and four female focus groups discussion.

In total, 163 persons (131 men and 32 women) participated in the consultations and received information about the Project, Land Acquisition and Resettlement Plan (LARP processes), bidding process and expected time for the beginning of the works, as well as a Project Information Brochure detailing the Project-specific entitlements, government decree on the cut-off date, MoT letter on the establishment of the GRM and details on the GRM procedure. Participants were supportive of the project and shared their concerns and suggestions on issues such as road safety, the need for animal underpasses and adequate compensation, amongst other issues.

Implementation

² The guidelines of the International Finance Corporation (IFC) have been used for assessing the impacts of traffic noise. They state that noise levels measured at noise receptors must not be 3 dB(A) greater than the background noise levels or exceed 55 dB(A) during the day or 45 dB(A) during the night in residential areas. The 3dB(A) criterion is applicable for this project as there is some ambient background noise due to traffic movement on the existing gravel / earth road in existing residential areas.

The EMP, its mitigation and monitoring programs identified in the EIA will be included within the Project Bidding Documents for works. This ensures that all potential bidders are aware of the environmental requirements of the Project and its associated environmental costs.

The Project Bidding Documents will state that the Contractor will be responsible for the implementation of the EMP through their own Site Specific Environmental Management Plan (SEMP). The SEMP will adopt all of the conditions of the EMP adding site specific elements that are not currently known e.g. The location and layout of contractor construction camps, lay down areas, borrow areas (if required), disposal areas and the operation measures for each and how their construction processes will ensure that the project is implemented in an environmentally acceptable manner.

The EMP and all its requirements will be included in the Contractors Contract, making implementation of the EMP a legal requirement under the Contract. The Contractor generated SEMP will be approved and monitored by the Engineer. Should the Engineer, through routine monitoring by his national and international environmental specialists, note non-conformance with the SEMP the Contractor can be held liable for breach of the contractual obligations of the EMP. To manage and ensure compliance with the SEMP the Contractor will employ a national environmental specialist to monitor and report Project activities throughout the Project Construction phase.

A **grievance redress mechanism** (GRM) has been prepared as part of the EIA for the Project. The GRM provides a structure for stakeholders to make complaints and a mechanism for the complaints to be resolved both locally and centrally.

Conclusions

Environmental and social benefits of the project far outweigh the minor and temporary inconveniences that will arise during project implementation, provided the EMP is fully implemented. The EIA including its EMP are considered sufficient to meet the environmental assessment requirements of ADB, EBRD and Government of Tajikistan.

1 Introduction

1.1 Project Location and Setting

1. Tajikistan is a landlocked country of Central Asia (Figure 1). It relies on road transport for international trade. The Rogun Hydro Power Project (HPP), including the Rogun Dam, located approximately 100 km east of Dushanbe, is being built to harness the hydropower potential of the Vahdat River. Following the impoundment of the dam, the reservoir is being filled and in time it will cover the existing M-41 road that runs from Dushanbe to the border with the Kyrgyzstan Republic at Karamyk.
2. The proposed project “Obigarm - Nurobod Road Project” is to build a replacement 76 km road for the M-41 in the mountain range to the north of the Vahdat River Valley (see Figure 2 alignment and Figure 3 schematic showing bridges and tunnels).

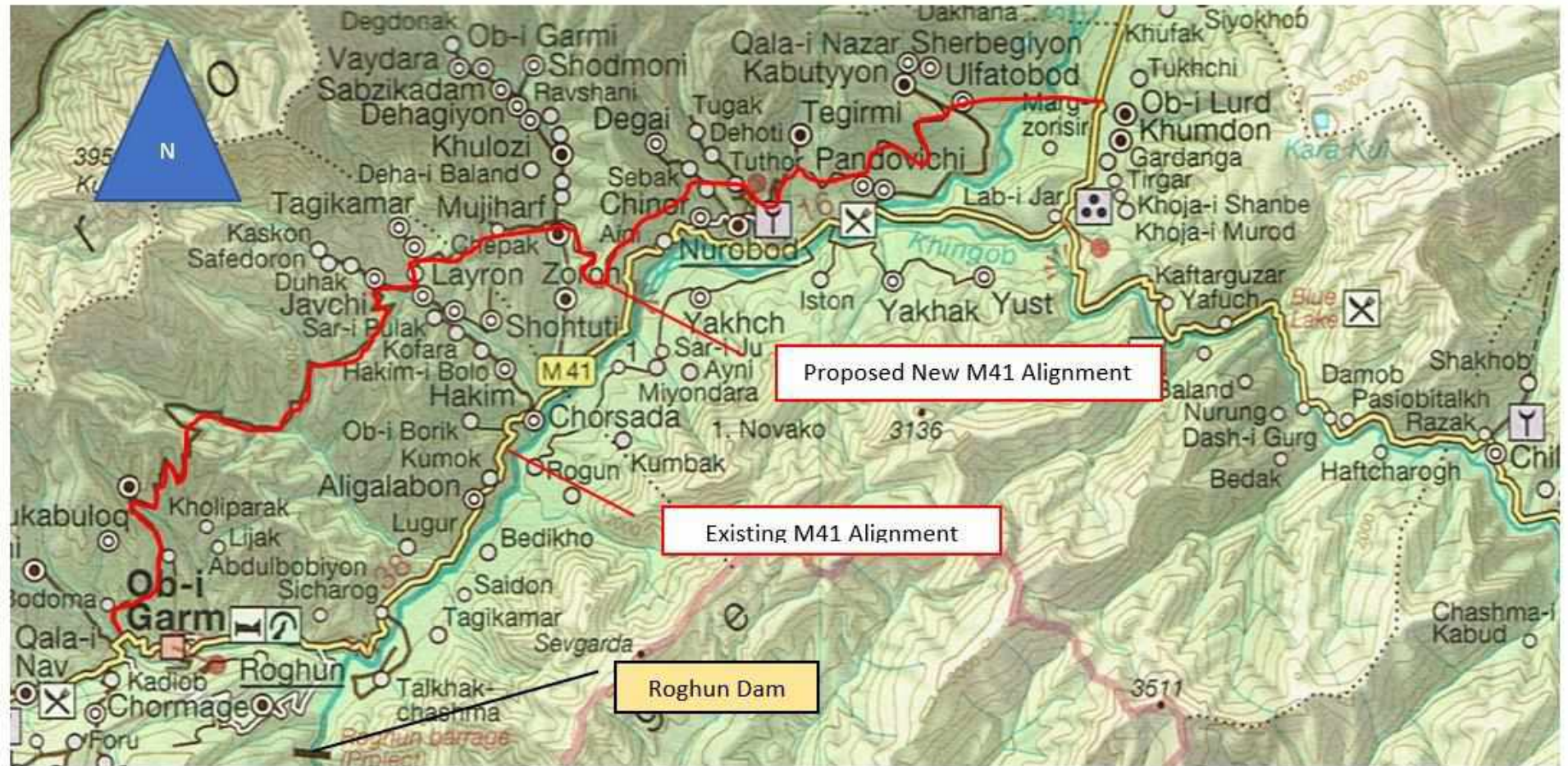
Figure 1: Tajikistan in Central Asia and the Project in Tajikistan



Source: Complete Atlas of the World, 2nd Edition, DK Publishing (2012)

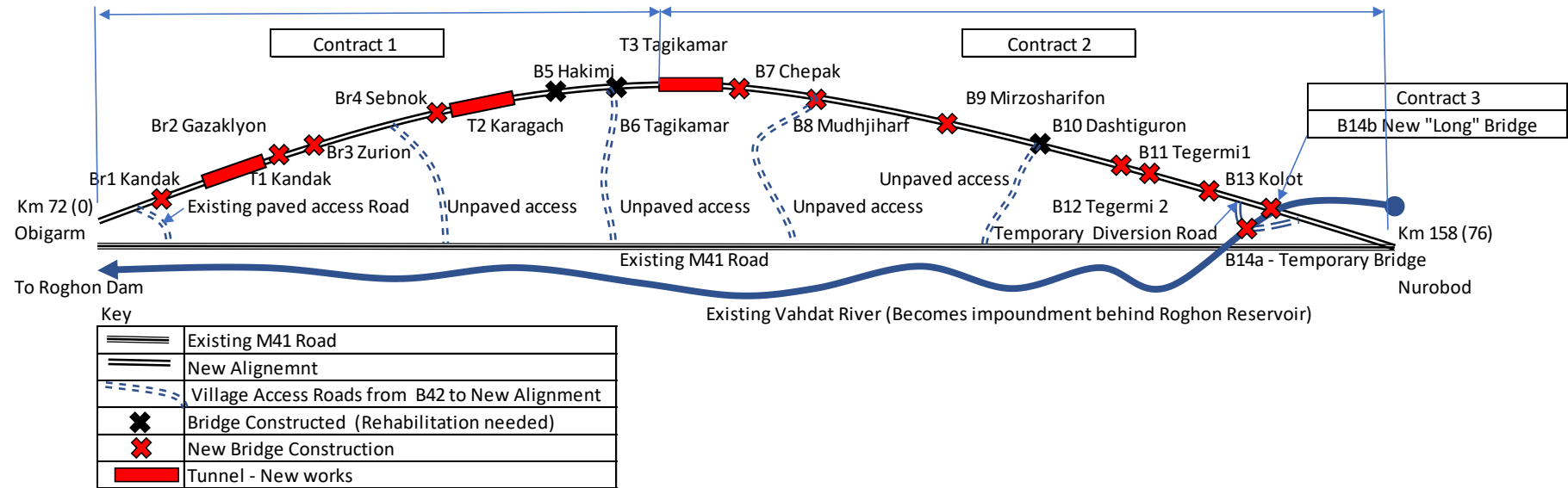
3. During the consultation process carried out for this project [Package 1 LARP (December 2018) & Package 2 LARP July 2019)], it was determined that a population of 16,438 are located along the alignment. The following table sets out this information.

Figure 2: Existing and Proposed M41 road replacement (The Project)



Source: Southern Tajikistan – Tourist Map, Gecko Maps. www.geckomaps.com

Figure 3: Schematic of Alignment showing location of bridges, tunnels and access points



Source: Prepared for this EIA document

Table 1: Population of the Project Villages on the alignment

District / Hukumat	Subdistrict / Jamoat	Villages along the Project road	Population	Male	Female	No of Households (HH)	Person / per HH (average)
Rogun	Obi Garm	Bozorak	98	49	49	16	6
		Kandak	2,318	1,228	1,090	250	9
	Sicharog	Shohi Aslon	250	132	118	28	9
Nurobod	Hakimi	Chavchii Poyon	445	239	206	61	7
		Sadokat	456	246	210	63	7
		Layron	1,312	692	620	153	8
		Siyagulak	968	518	450	136	7
	Muchiharf	Chepak	282	133	149	28	10
		Muchiharfi Kalon	1,411	709	702	169	8
	Komsomolobod	Degai	725	361	364	107	7
		Tuhtor	562	280	282	58	10
		Tegermi	2,786	1,391	1,395	345	8
		Pandovchi	805	404	401	117	7
	Safedcheshma	Dehi Tag	1,250	635	628	142	9
		Ulfatobad	2,020	1,030	990	224	9
		Gulmon	148	72	76	14	10
	Darband	Navobod	602	294	308	96	6
Total			16,438	8,413	8,038	2,007	8

Source Project LARP (Package 1 Dec 2018 & Package 2 July 2019) Table 3.3

1.2 Background and Rationale for Project

4. The project will replace the existing corridor (Route M41) running immediately north of the Vahdat River that will be lost when the Rogun Dam reaches its final impoundment level. The new route is through the mountain ranges north of the Vahdat River Valley up to 1 km north of the existing M41 road alignment. A feasibility study of a replacement road commenced in 1975, in 1984 the project was approved, and the construction started and continued up to 1992 when the works were suspended during the period of the former Soviet Union break-up. During construction in the Soviet era:
 - bulk earthworks (cuttings and embankments) were substantially completed to create a road platform along the length of the alignment (except bridges and tunnel sections);
 - three bridges were constructed and ten planned but not constructed; and
 - two tunnel sections were planned and had preliminary works done, but no significant tunnelling was carried out.
5. The alignment is therefore discontinuous and has not been maintained in the intervening years since construction.
6. The proposed project “Obigarm - Nurobod Road Project” aims to construct a 76 km alternative alignment (the “Project road”) for the existing M41 highway connecting the northeast region of Tajikistan and the Kyrgyz Republic between Obigarm (72 km) and Nurobod (158 km). The current M41 will be inundated by the reservoir of the Rogun Hydropower Project (HPP), that is now under construction.

The project road is divided into three packages:

- (i) Package 1: the Obigarm - Tagikamar section is about 30 km long. It includes 2 tunnels of 1.6 km and 1.7 km, and local access roads of approximately 30 km;
- (ii) Package 2: the Tagikamar-Nurobod is about 44 km long. It includes 1 tunnel of 2.6 km and 1 long temporary bridge, and local access roads of approximately 40 km ; and
- (iii) Package 3 includes a permanent bridge that is approximately 760 m long, and its approaches.

These sections correspond to three contract packages that will be procured separately through open competitive bidding. The existing bridge over the Surkhkhob River on the M41 will be inundated in November 2023, so the new temporary bridge in Package 2 will need to be constructed before this date. The new temporary bridge will be inundated by November 2025, so the permanent bridge at Darband will need to be constructed before this date.

- **Package 1** will be financed by a USD 110 million grant from Asian Development Bank (ADB) and USD 40 million loan from Organisation of the Petroleum Exporting Countries (OPEC) Fund for International Development (OFID). Package 1 consists of the following sections of the Road:

- Section 1 - Javoni – Kandak
- Section 2 - Gazakyon – Sebnok (Lugur);
- Section 3 - Hakimi – Siyohgulak;
- Bridge No 1 through Bridge No 6

- Tunnel No 1 (Kandak Tunnel); and
- Tunnel No 2 (Karagach Tunnel)

ending short of the south portal of Tunnel No 3 (Tagikamar Tunnel).

- **Package 2** will be financed by USD 150 million loan from European Bank for Reconstruction and Development. Package 2 consists of the following sections of the Road from 33 km:
 - Section 4 - Mudzhiharv-Alihodzha;
 - Section 5 - Alihodzha – Tuthor;
 - Section 6 - Tuthor – Kabudiyon (Samsolik);
 - Section 7 - Kaboudiyon – Humdon
 - Bridge No 7 through Bridge No 13;
 - Tunnel No 3 (Tagikamar Tunnel); and
 - The temporary bridge over the Surkhkhub River at Darband.
- **Package 3** will be financed by USD 40 million loan from Asian Infrastructure Investment Bank (AIIB) and covers the long permanent bridge (760 m) over the Rogun HPP Reservoir at Darband over the Surkhkhub River.

The respective chainage is presented in Table 2.

Table 2: Project Sections and Chainage

Section	Financier
Section 1: km 0+000 to km 30+217	ADB/OFID
Section 2: km 30+217 to km 75+600, less the section for Package 3 which runs from km 72+900 to km 74+303	EBRD
Section 3: km 72+900 to km 74+303 including the 760 m bridge	AIIB

7. The existing road corridor is part of the Central Asia Regional Economic Cooperation (CAREC) road network, comprising an element of corridors 2, 3 and 5 that runs from the Karamyk border crossing (with Kyrgyzstan) and the city of Dushanbe. A schematic of the CAREC network is shown in Figure 4.

The map displays Central Asia and surrounding regions, including Azerbaijan, Turkmenistan, Uzbekistan, Kazakhstan, Kyrgyz Republic, Tajikistan, Afghanistan, Pakistan, Mongolia, and Inner Mongolia Autonomous Region. It highlights the Karamyk border and CAREC Corridors 2, 3, and 5 (Subject alignment). The map also shows the Dushanbe area and the Arabian Sea. A legend indicates the proposed CAREC Logistics Centres and the alignment of CAREC Corridors 1 through 6. A scale bar shows distances in kilometers (0, 200, 400, 600). A note at the bottom states: 'This map was produced by the cartography unit of the Asian Development Bank. The boundaries, colors, denominations, and any other information shown on this map do not imply, on the part of the Asian Development Bank, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries, colors, denominations, or information.'

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1.3 Project Proponent and Main Institutional Responsibilities

8. The Implementing Agency (IA) for the project is the Project Implementation Unit for Road Rehabilitation (PIURR) of the Ministry of Transport (MoT) of Tajikistan and office facilities were provided on the fifth floor of the Ministry offices, 14 Aini Street, Dushanbe. The National Design Consultant is Avtostrada.

1.4 EIA Objectives, Methodology and Structure

9. The project's environmental and social assessment needs to comply with both the legal requirements of Tajikistan and the lenders - ADB and EBRD policies.
10. The methodology used for the preparation of this EIA report is based on the ADB Safeguard Policy Statement (2009) EBRD Environmental and Social Policy (ESP 2014) and Performance Requirements (PRs) and Tajikistan's environmental and social legislation and permitting processes.
11. The EIA focuses on the design, construction and operation of the alignment and also considers potential environmental and social (E&S) impacts relating to associated facilities, including:
 - Village access roads – these will be permanent access roads, connecting villages to the alignment;
 - Site construction access routes- these will be temporary access roads for use by construction traffic during the construction period;
 - Borrow pits (quarry sites);
 - Storage and disposal areas (if required) for waste materials;
 - Manufacturing / processing area(s) for concrete, asphalt and rock crushing / grading;
 - Construction camps (offices, storage, maintenance and accommodation); and
 - Maintenance depots (operational phase).
12. This EIA covers Lots 1 and 2 only. An impact assessment of the proposed permanent long bridge over the Surkhob River (Lot 3) will be conducted as an addendum to this EIA, but will be disclosed separately.
13. The Project area was visited for surveying of baseline data by the international and national consultants during Q3 and 4 2018, and a field survey for biodiversity was conducted in May 2019. The surveys conducted are discussed in Section 5 of this EIA.
14. Extensive consultation meetings were conducted at the village level across the alignment in Q3 / 4 2018. The purpose of the consultation was to inform people about the project, to receive their feedback and to incorporate these comments and concerns into the design process. Minutes of the various consultation meetings undertaken are summarised in Section 6. Data and information obtained during the consultations have been included through the document where appropriate. Additional background data and information was obtained from published and unpublished sources (e.g., on climate, topography, geology and soils, natural resources flora and fauna, agriculture, and socio-economic data) and reviewed as part of this EIA.
15. During the consultation process, environmental issues were not raised by the local population. However, concerns related to road safety, compensation for land losses and relocation were raised, and processes have been developed to address these issues. There was a high level of support for the project as a mechanism to improve prosperity, education opportunity and communication.
16. During the construction period there will be a regular monitoring in accordance with the requirements presented in the Environmental Management Plan, which forms part of this EIA (see Section 8).

17. Land issues and impacts are addressed in detail the land acquisition plans that have been developed for the project.
18. This EIA includes an executive summary, text in nine sections, including a summary, and annexes. The document structure is:
 - Executive Summary
 - Section 1 – Introduction
 - Section 2 – Legal, Administrative and Policy Frameworks
 - Section 3 – Description of the project
 - Section 4 – Analysis of alternatives
 - Section 5 – Description of the Existing Environment
 - Section 6 – Consultations and Information Disclosure
 - Section 7 – Assessment of Impacts
 - Section 8 – Environmental Management Plan
 - Section 9 - Conclusions and recommendations
 - Annexes present documents reviewed during the study, noise modelling output, details of consultations and monitoring equipment certifications.
19. An impact assessment of the proposed village access roads will be conducted as a supplement to this EIA, and will be disclosed. This assessment will include consultation with stakeholders and identification and assessment of the potential impacts on environmental and social receptors (biodiversity, cultural heritage etc.).
20. An impact assessment of the proposed permanent long bridge will also be conducted as an addendum to this EIA, but it will be disclosed separately outside the timescales described above, once the detailed design has been prepared.

1.5 Supporting Documents

21. A list of documents that have been reviewed during the preparation of this EIA are included in (Annex 1).
22. The dedicated Project team has prepared the following documentation based on the Avtostrada Design:
 - Geotechnics: Interim Report (December 2018);
 - Road Safety: Detailed Design Stage Road Audit Report for the proposed Obi Garm – Nurobod Highway, Northern Tajikistan, final (15 November 2018);
 - Traffic / Economics: Interim Economic Evaluation for DFR (22 November 2018);
 - Tunnels - Due diligence of tunnel aspects and tunnel specifications (December 2018);
 - Structural Engineer Design Review: Detailed Design Bridge Engineering, Interim Report (December 2018);
 - Land Acquisition and Resettlement Plan [LARP] (Package 1 Dec 2018 & Package 2 July 2019);
 - Social and Gender Impact Assessment (Dec 2018);
 - Vahdat – Rasht – Jirgatal – Kyrgyzstan Border Road (From km 72 to km 158), Bridges Nos 9, 11, 12, 13: Technical Report on the Results Of Engineering-Geological Surveys For The Development Of Working Design: Ref 16-16-EG- (December 2018);
 - Vahdat – Rasht – Jirgatal – Kyrgyzstan Border Road (From km 72 to km 158), Bridge Across Dashtiguron River: Technical Report On The Results Of Engineering-Geological Surveys For The Development Of Working Design: Ref 16-16-EGR, Dushanbe, 2018
 - Hydrological Report – 16-16-EGI (in 2 parts, undated);
 - Technical Assessment Report (Working Draft 1) Assessment of Climate Change Risks to Vahdat – Kyrgyz Border Rehabilitation Project, May 2019, Mott MacDonald.

- Vahdat – Rasht – Jirgatal – Kyrgyzstan Border Road (From km 72 to km 158), Stage II Road Section From Chainage 424+80 To Chainage 759+14: Technical Report On The Results Of Engineering-Geological Surveys For The Development Of Working Design: Ref 16-16-Egs, Dushanbe, 2018
- Vahdat – Rasht – Jirgatal – Kyrgyzstan Border Road (From km 72 to km 158), Stage II Road Section From Chainage 0 to Chainage 424+80: Technical Report On The Results Of Engineering-Geological Surveys For The Development Of Working Design: Ref 16-16-Egs, Dushanbe, 2018
- Preparing the Central Asia Regional Economic Cooperation Corridors 2, 3, and 5 (Obigarm-Nurobod) Road Project Consultants' Services; Inception Report – Geotechnical Consultancy Services, August 2018
- Geological engineering study for the Tajikamar Tunnel, Avtostrada Report Ref 16-16-AS.T03-CS-EN, 2017

2 Legal, Administrative and Policy Frameworks

2.1 Introduction

23. This section provides an overview of strategies / legal norms and guidelines on environmental assessment in Tajikistan which have been followed for other implemented projects in the Republic of Tajikistan. This section also identifies the relevant strategies and security policies of the Republic of Tajikistan, the Asian Development Bank (ADB), The European Bank for Reconstruction and Development (EBRD), as well as other international financial institutions (WB, AIIB³, etc.) that will be applied. The project will require the implementation of all national and international environmental and social policies guidelines and performance requirements.

2.2 Asian Development Bank Safeguards Policy Statement (2009)

24. This EIA has been prepared following the guidance contained in the Asian Development Bank Safeguards Policy Statement⁴ (SPS 2009) and the EBRD Environmental and Social Policy 2014⁵ (ESP 2014).
25. The ADB SPS describes common objectives of ADB's safeguards, lays out policy principles, and outlines the delivery process for ADB's safeguard policy.
26. The Safeguard Policy Statement (SPS) builds upon three previous safeguard policies on:
- the environment;
 - involuntary resettlement; and
 - indigenous peoples,

It brings the three safeguards policies into one single policy that enhances consistency and coherence, and more comprehensively addresses environmental and social impacts and risks.

27. The SPS aims to promote sustainability of project outcomes by protecting the environment and people from projects' potential adverse impacts by:
- avoiding adverse impacts of projects on the environment and affected people, where possible;
 - minimising, mitigating, and/or compensating for adverse project impacts on the environment and affected people when avoidance is not possible; and
 - helping borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.
28. An Annex to Appendix 1 of the SPS sets out a framework for Environmental Impact Assessment reporting and this document follows the format.

2.3 EBRD ESP and Performance Requirements

29. All projects financed by the EBRD shall be structured to meet the requirements of the ESP. The EBRD has adopted a comprehensive set of specific Performance Requirements (PRs) that the projects are expected to meet:
- PR1: Environmental and social appraisal and management;
 - PR2: Labour and working conditions;
 - PR3: Pollution prevention and abatement;
 - PR4: Community health, safety and security;
 - PR5: Land acquisition, involuntary resettlement and economic displacement;

³ WB – World Bank, AIIB – Asian Infrastructure Investment Bank.

⁴ <https://www.adb.org/documents/safeguard-policy-statement>

⁵ <https://www.ebrd.com/news/publications/policies/environmental-and-social-policy-esp.html>

- PR6: Biodiversity conservation and sustainable management of living natural resources;
 - PR7: Indigenous people (none affected by this Project);
 - PR8: Cultural heritage;
 - PR9: Financial intermediaries; and
 - PR10: Information disclosure and stakeholder engagement.
30. Performance Requirements no. 1, 2, 3, 4, 5, 6, 8, and 10 are applicable to the Project, and have been considered within this EIA document.

2.4 European Union Regulations

31. The EBRD, as a signatory to the European Principles for the Environment is committed to promoting the adoption of EU environmental principles, practices and substantive standards by EBRD-financed projects, where these can be applied at the project level, regardless of their geographical location.
32. The following EU Directives are potentially relevant to the Project, and have been considered within this EIA document:
- The Environmental Impact Assessment Directive 2014/52/EU)
 - Birds Directive, 2009/147/EC;
 - Habitats Directive 92/43/EEC Directive 2008/96/EC
 - Road Infrastructure Safety Management 2008/96/EC
 - Directive 2004/54/EC on Safety Requirements for Tunnels
 - Air Quality Directive 2008/50/EC
 - Water Framework Directive 2000/60/EC
 - Groundwater Directive 2006/118/EC
 - Directive 2006/54/EC on the implementation of the principle of equal opportunities and equal treatment of men and women in matters of employment and occupation
 - The European Framework Directive on Safety and Health at Work (Directive 89/391 EEC)
33. Tajikistan is a party to international environmental agreements, including those most relevant to this project, which are listed in Table 3.

Table 3: Environmental Conventions Potentially Relevant to This Project

No	Name of the document	When the document approved
1.	Vienna Convention for the Protection of the Ozone Layer	November 4, 1995
2.	Convention on Biological Diversity and to its Cartagena Protocol on Biosafety	May 15, 1997
3.	UN Framework Convention on Climate Change	December 13, 1997
4.	Convention to Combat Desertification	December 28, 1998
5.	Convention on Wetlands of International Importance Mainly as a Habitat for Waterfowl	October 24, 2000
6.	Convention on the Conservation of Migratory Species of Wild Animals	October 24, 2000
7.	Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters	June 9, 2001
8.	Convention on Persistent Organic Pollutants	December 6, 2006
9	Convention for the Protection of the World Cultural and Natural Heritage	1992
10	Convention on International Trade in Endangered Species of Wild Fauna and Flora	2016

No	Name of the document	When the document approved
11	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	2016

2.5 Tajikistan Country Policies and Institutional Framework for Environment, Labour and Health & Safety

2.5.1 Introduction

34. The legislation on environmental protection of the Republic of Tajikistan includes laws on air quality, mineral resources, on land and forest management, on health and safety, on waste and chemicals management. The “Framework” Law on Environmental Protection of the Republic of Tajikistan was adopted in 1993, and amendments were made in 1996, 2003, and then in 2011. A new law on environmental protection was adopted. The Water Code was adopted in 2000, the Land Code - in 1992, the Land Management Code - in 2001.
35. Environmental impact assessment (EIA) is the subject of the Law on Environmental Protection (2011), the Law on Ecological Expertise (2012), and the Law on Environmental Impact Assessment (updated in 2018). An environmental licensing system applies to hazardous waste management and mining. Environmental permitting systems regulate the use of natural resources, especially hunting or collecting certain species.
36. In Tajikistan, the organizations responsible for monitoring environmental and health and safety protection and their management are
- the Committee for Environmental Protection under the Government of the Republic of Tajikistan (CEP)
 - the Sanitary Inspectorate under the Ministry of Health (SES)
 - the Industrial Safety Inspectorate; and
 - the Field Development Inspectorate.
37. The Law on Environmental Protection contains articles that relate to the protection of the subsoil and the efficient use of land resources. The main environmental laws are indicted in Table 4:

Table 4: Environmental, Labour and Health & Safety Laws of the Republic of Tajikistan

No	Name of the documents	When the document was approved
<i>In the field of environmental protection</i>		
1.	Law of RT "On Environmental Protection"	August 2, 2011
2.	Law of RT "On Ecological Expertise"	April 16, 2012
3.	Law of RT "On Environmental Impact Assessment"	November 1, 2018
4.	Law of RT "On the protection of atmospheric air"	December 28, 2012
5.	Law of RT "On production and consumption waste"	May 10, 2002, amended in 2011
6.	Law of RT "On Environmental Audit"	December 26, 2011
7.	Law of RT "On Specially Protected Natural Territories"	December 26, 2011
8.	Law of RT "On Environmental Monitoring"	March 25, 2011
9.	Law of RT "On Radiation Safety"	August 1, 2003
10.	Law of RT "On the protection and use of flora"	May 17, 2004
11.	Law of RT "On Biological Security"	March 1, 2005
12.	Law of RT "On fauna"	January 5, 2008

No	Name of the documents	When the document was approved
13.	Law of RT "On Soil Protection"	October 16, 2009
14.	Law of RT "On hydrometeorological activity"	December 2, 2002
15.	Law of RT "On the collection, conservation and rational use of genetic resources of cultivated plants"	August 1, 2012
<i>In the field of health, social protection and emergency situations</i>		
1.	Law of RT "On the protection of public health"	May 15, 1997
2.	Law of RT "On ensuring sanitary-epidemiological safety of the population"	December 8, 2003
3.	Law of RT "On counteraction to HIV\AIDS"	December 28, 2005
4.	Law of RT "On protection of population and territories from emergency situations of natural and man-made character"	July 15, 2004
5.	Law of RT "On Fire Safety"	December 29, 2010
6.	Law of Republic of Tajikistan on Appeals of Individuals and Legal Entities	2016
7.	Law on public sanitation and epidemiology welfare	2013
<i>In the field of energy, industry and minerals</i>		
1.	Law of RT "On Energy Saving"	May 10, 2002
2.	Law of RT "On mineral resources"	July 20, 1994
3.	Law of RT "On precious metals and precious stones"	May 12, 2001
4.	Law of RT "On industrial safety of hazardous production facilities"	February 28, 2004
<i>In the field of water and land relationship, agriculture</i>		
1.	Law of RT "On drinking water and drinking water supply"	December 29, 2010
2.	Law of RT "On Land Reform"	March 5, 1992
3.	Law of RT "On Land Valuation"	May 12, 2001
4.	Law of RT "On Land Management"	January 5, 2008, amended 2016
5.	Law of RT "On the production and safe handling of pesticides and agrochemicals"	April 22, 2003
<i>Codes</i>		
1.	Land Code of the Republic of Tajikistan	December 13, 1996, amended in 2016
2.	Water Code of the Republic of Tajikistan	October 20, 2000
3.	Forest Code of the Republic of Tajikistan	August 2, 2011
4.	Labour Code of the Republic of Tajikistan	2016

38. These laws, along with the normative acts (for example Regulation # 641 "Order of compensation for losses of land users and damage of the agricultural production process", approved by the Resolution of the Government of the Republic of Tajikistan (2011) approved by the Government of the Republic of Tajikistan, create a favourable legal environment for the protection of the environment in the Republic as well as the use and protection of its natural resources. The most appropriate of these laws, codes and regulations are described in more detail in the following subsections.

2.6 Tajikistan Law / Regulation on Environment

2.6.1 Fundamental Law on the Environment

39. The fundamental law on the environment - the Law "On Environmental Protection" - adopted in 2011 (July 21, 2011, No. 208). The previous Law on Nature Protection ceased to exist in 2011. The new Law proclaims that the policy of the Republic of

Tajikistan in the field of environmental protection should be aimed at ensuring the priority of environmental measures, taking into account a scientifically based combination of economic development and other activities that affect the environment. environment, with respect for nature and the rational use of natural resources. The law defines the applicable legal principles, protected objects, the competence and role of the government, the Committee for Environmental Protection under the Government of the Republic of Tajikistan, local executive state authorities, public organizations and citizens.

40. The law also stipulates measures to guarantee the protection of the right of society and citizens to a healthy environment, and imposes a duty to undertake an environmental impact assessment when making any decision on an activity that could have a negative impact on the environment. The law also defines environmental emergencies and environmental disasters, and prescribes procedures for dealing with such situations; defines the responsibilities of officials and enterprises to prevent and eliminate harmful environmental consequences, as well as the responsibility of citizens and organizations. The law defines the types of control over compliance with the provisions of environmental legislation: state, departmental, industrial and public control. State control is carried out by the Committee for Environmental Protection (CEP), the Health Inspectorate of the Ministry of Health, the Industry Safety Inspectorate and the Extractive Industry Inspectorate. Public control is carried out by public organizations or labour collectives, and a state body, enterprise, organization or official may be subject to verification.

2.6.2 Environmental Expertise Act

41. The Law on Ecological Expertise (2012) determines the principles and procedure for conducting an environmental impact assessment and is aimed at preventing the harmful effects of a planned economic and other activity on the environment and the social, economic and other consequences of the implementation of the object of environmental impact assessment.

2.6.3 Environmental Impact Assessment Act

42. The Law on Environmental Impact Assessment (2018) establishes the legal and organizational framework for environmental impact assessment, its relationship with state environmental impact assessment, as well as the procedure for recording and classifying objects for environmental impact assessment.

2.6.4 Water Code

43. The Water Code (2000) provides for a policy on water management that allows dispute settlement, utilization and cadastral planning. It contributes to the rational use and protection of water resources and determines the types of rights to use water resources, powers and the role of regional and local authorities for the allocation of rights to water use among different users, collection of fees, water use planning, water use rights and dispute resolution.

2.6.5 Land Code

44. The current Land Code (1992, amended 2016). The Land Code regulates land relations and is aimed at rational "use and protection of land and soil fertility ...". Land is subject to rational use, and the Code allows local authorities to make decisions regarding "rational" land use.

2.6.6 Land Management Act (2001)

45. The law requires authorities to perform mapping and monitoring of land quality, including on soil pollution, erosion and waterlogging.

2.6.7 Law on the Licensing of Certain Types of Activities (2004, amend 2015)

46. It includes several types of activities, in particular handling hazardous waste; environmental audit; collection and processing of ferrous and non-ferrous scrap metals; and others. The licenses are to be issued by the CEP under the Government, which is also the specially authorised state body in charge of regulating environmental audit.

2.6.8 Legal Framework for Environmental Penalties

47. When detecting violations of environmental legislation, waste management in particular, the CEP authorities apply penalties in accordance with the following articles of the Administrative Code of the Republic of Tajikistan. Namely:
- Article 223. Violation of standards, rules, regulations, instructions and other environmental requirements for the protection of the environment and the rational use of natural resources;
 - Article 224. Release (discharge) of polluting substances into the environment with excess of standards or without a permit, waste disposal, physical and other harmful effects
 - Article 232. Violation of environmental protection requirements during transportation, disposal, use, disposal (dumping) industrial, household and other wastes into the natural environment.
48. The fines can only be witnessed by the local CEP authorities.

2.7 Legal Framework for EIA, Environmental Licences and Permits

2.7.1 Overview

49. There are three laws in the republic, which stipulate all aspects of the Environmental Impact Assessment:
- the Law “On Environmental Protection”;
 - the Law “On Ecological Expertise”; and
 - the Law “On Environmental Impact Assessment”.
50. Chapter V (articles 33-39) of the Law on Environmental Protection (2011) introduces the concept of state environmental impact assessment, the task of which is the State Ecological Expertise (SEE) to determine whether the planned activities and projects comply with environmental legislation, established standards and the environmental safety of society. These laws stipulate the mandatory requirement for carrying out state environmental impact assessment for all types of economic and other activities, based on the principles of scientific validity, objectivity and comprehensiveness, the legality of the conclusions of environmental impact assessment. The SEE precedes the decision on the object of environmental expertise in order to prevent possible adverse effects of this activity on the environment.
51. Funding for programs and projects is allowed only on receipt of positive opinions by SEE. The following types of economic activities and projects are subject to SEE: a) draft state programs, materials prior to preliminary planning, feasibility studies, economic development schemes; b) regional and sectoral development programs; c) urban planning and territorial plans, development and development schemes; d) environmental programs and projects; e) construction and reconstruction of various objects, regardless of the form of their property; e) draft standards for environmental quality and other regulatory, technological and methodological documentation governing economic activities; g) existing enterprises and business entities, etc.

52. Laws require that all types of business and other activities are carried out in accordance with established environmental standards and regulations, and provide for adequate measures to mitigate and protect the environment to prevent pollution and improve its condition. Evaluation of materials for SEE, which presents an analysis of short-term and long-term environmental, genetic, economic and demographic impacts and consequences, is carried out before decisions are made on the location, construction or reconstruction of facilities, regardless of the form of their ownership. If a violation of environmental protection requirements occurs, construction may be suspended or terminated until measures are taken to improve the situation, by order of the CEP and / or other authorised regulatory bodies, such as sanitary and epidemiological, geological, and public security agencies.

2.7.2 Environmental Impact Assessment

53. Environmental Impact Assessment (EIA) is an integral part of the state environmental review, as provided for in the Procedure of Environmental Impact Assessment (adopted by the Resolution of the Government of the Republic of Tajikistan No. 532). EIA is the responsibility of the initiator of the project. Conducting a State Environmental Review of all investment projects is the responsibility of the Committee for Environmental Protection under the Government of the Republic of Tajikistan (CEP) and its regional offices. In addition, according to the 2018 Law on State Environmental Review, all construction work, including rehabilitation, must be assessed for their environmental impact and proposed mitigation measures and monitored by the CEP.

2.7.3 Consideration of Categories

54. Annex 1 to the Resolution No. 532 of the Government of the Republic of Tajikistan includes the approved the list of facilities and activities for which the development of materials for environmental impact assessment is required. According to this document, objects and activities are divided into 4 categories of environmental impact:
- A impact category – high risk
 - B (B) impact category – medium risk
 - B (V) impact category – low risk
 - Г (G) impact category – minimal or no risk
55. This Project belongs to the A category of environmental impact (highways of national importance). The B and B categories of environmental impact are respectively roads of regional and local importance (rural roads). A Preliminary Data analysis under the Tajikistan System is presented in Annex 2

2.7.4 Administrative Basis for EA

56. The Law on Environmental Protection determines that the state environmental review is conducted by an authorised state body of the Republic of Tajikistan in the field of environmental protection, i.e. Committee on Environmental Protection. The CEP has a significant mandate, which includes environmental policy and inspection duties. The CEP has units at the regional, city and district levels, in the form of environmental protection departments.
57. A special unit under the Committee (CEP) is charged with leading and managing the process of EIA and SEA. For the preparation of EA, initiators of state and private sector projects are responsible for, in addition to complying with environmental regulations, rules and procedures in a particular sector, standards established in other sectors and environmental standards adopted by other line agencies, in particular, sanitary and epidemiological, geological, water, etc.

2.7.5 Public Participation

58. Article 12 of the Law on Environmental Protection stipulates the right of citizens to live in a favourable natural environment and to protect their health from adverse effects. Citizens also have the right to receive environmental information (Article 13), as well as the right to participate in and monitor the development, adoption and implementation of decisions related to the impact on the environment (Article 13). This right is ensured by the publication and public discussion of draft environmentally important decisions. The duty of the competent authorities is to take into account the suggestions and comments of citizens. On 17 July 2001, Tajikistan acceded to the Aarhus Convention on access to information, public participation in decision-making and access to justice in environmental matters. The provision of this Convention on the right to conduct public environmental impact assessment prevails over the provision of the national law.
59. According to the law, for any project subject to and EIA, the public has the right to initiate a public environmental assessment prior to or concurrently with the state environmental assessment. The outcome of the public assessment is of an advisory nature and has to be reviewed during the state environmental assessment. The EIA is carried out by an expert or an expert committee, as set out in the legislation. According to the EIA law, depending on the significance of environmental impacts, a project can be assigned a category "A", "B", "V" and "G". Review of the documents can take up to 60 days depending on the category of the project. As a result of the review, a positive or a negative conclusion is issued by the state institution. A positive conclusion is often supplemented by recommendations, for example, obtaining additional permits (emissions to air, wastewater discharge and waste) and activities to improve the surrounding environment. The conclusion is valid for the duration of the life cycle of the technology. If changes are made to the work processes or technologies which result in greater/smaller impact on the environment, a new assessment will have to be carried out.
60. The public has the right to request public hearings to be carried out. For category "A" and "B" projects, the authorised state body should develop a stakeholder engagement plan with the possibility of conducting consultations and taking into account the opinions of citizens.
61. In Tajikistan disagreements are resolved through Jamoats' (Hukumats') grievance mechanism or appeal to court. A grievance redress mechanism (GRM) capable of receiving and facilitating the resolution of affected persons' concerns and grievances related to the project is required as a formalised way for the PIURR to identify and resolve concerns and grievances.

2.7.6 Environmental Permits and Licences

62. The 2011 Law on Permitting set the legal, organizational and economic basis for the permits system: the list of activities that require a permit, the permitting procedure, and the types of permits and the competent state bodies authorised to issue them. The Law was one of the elements of the country's permit system reform that reduced the total number of types of permits (more than 600) to only 88. Eight types are issued by the CEP.
63. An indicative list of the permit types which may be required for the Project is provided in Table 5

Table 5: Indicative List of Permits and Licences Applicable to the Project

Description of Authorisation Document	Date of Issue	Issuing Authority
Design Stage: Project Feasibility Study and Environmental Impact Assessment		
Conclusion of the State Ecological Expertise on the project	Final EIA Report	Committee for Environmental Protection under the Government of the Republic of Tajikistan (CEP RT)
At the Construction Stage: Permits and Licences		
License to conduct the type of activity	Prior to construction	Ministry of Industry and New Technologies of the Republic of Tajikistan
Permission for land use for the construction of the camp, asphalt and concrete plants and the development of quarries for the extraction of soil for the preparation of building materials (gravel, sand, crushed stone) and excavation for road pavement.	Prior to construction	Local authorities (Hukumats)
Permission for special water use	Before and during construction	(CEP RT), Tajikgeology (technical water), Ministry of Health and social defence of the population of the Republic of Tajikistan (drinking water)
Permission to cut down trees and shrubs	At the construction stage	(CEP RT)
Permission for emissions of harmful substances into the atmosphere (MPE) from stationary and mobile sources	At the construction stage	(CEP RT)
Permission for discharge of hazardous substances into water bodies (MPD)	At the construction stage	(CEP RT)
Permission for land acquisition for temporary storage of construction waste (substandard soil, old asphalt, dismantled concrete products, etc.)	At the construction stage	(CEP RT), Local authorities (Hukumats)
Permission to remove construction and household waste for storage in specially designated areas (disposal areas)	As required	Local authorities (Hukumats)

2.8 Environmental Standards

64. Standards are established for atmospheric and water pollution, noise, vibration, magnetic fields and other physical factors, as well as for the residual content of chemicals and biologically harmful microbes in food. Exceeding these levels leads to administrative actions, including financial sanctions. Some ministries, each in their area of responsibility, define environmental quality standards. For example, acceptable levels of noise, vibration, magnetic fields, and other physical factors are established by the Ministry of Health.

65. The environmental quality standards in Tajikistan are based on GOST, SNiP and SanPiN. GOST (Tajik: GOST) refers to a set of technical standards that is supported by the Euro-Asian Council for Standardization, Methodology and Certification (EASM), a regional standardization organization working under the auspices of the Commonwealth of Independent States (CIS). SNiP means technical standards (in Tajik: SNIP) – it is a construction code, a set of rules that define minimum standards for constructed facilities, such as buildings and undeveloped buildings. SanPiN (in Tajik: Koidakho wa meyorhoi sanitation) stands for sanitary rules and norms (standards).
66. Environmental quality standards in Tajikistan are provided by both MDK (in Tajik: MAC) and DVA (in Tajik: PDV). The maximum allowable concentration approved by the law on hygienic standards. By MDC is meant the concentration of chemical elements and their composition in the environment, which, when exposed daily for a long time in the human body, will lead to pathological changes or diseases established by modern research methods at any time in the life of the present and future generation. Maximum permissible (or allowed) emissions (MEL) are the standard maximum permissible emissions of harmful (polluting) substances into the atmospheric air, which are established for a permanent source of air pollution in accordance with technical standards for emissions and background air pollution. This ensures that standards for environmental air quality and hygiene are not exceeded, the most permissible (critical) loads on environmental systems and other requirements of environmental regulations.
67. Table 6 presents an overview of the National Standards and Regulations that apply to the Project.

Table 6: National Standards Applicable to the Project

No	National Standards –GOSTs
1.	31431—2011, Protection of nature, air. The number of maximum allowable emissions (MAE), November 29, 2011
2.	31434—2011, Protection of nature, air. Determination of efficiency parameters of dust removal systems, November 29, 2011
3.	IEC 61241-0—2011, Electrical equipment used in areas containing flammable dust. Part 0. General requirements, 29 November 2011
4.	GOST 17.0.0.01-76 (STSEV 1364-78) (in addition to 1987) A system of standards for the protection of the environment and the improvement of the use of natural resources. Generalities.
5.	General provisions GOST 17.0.0.04-80 (1998) nature Protection. Environmental passport (certificate) of industrial facility. Generalities.
6.	GOST RISO14001-98. Environmental management systems. Requirements and guidelines.
7.	GOST 17.0.0.02-79 (1980). Protection of Nature. Providing metrological control of air, surface water and soil pollution.
8.	GOST 17.1.1.01-77 (STSEV 3544-82). Use and protection of water. General conditions and definitions.
9.	GOST 17.2.1.01- 76. Classification of emissions (content).
10.	GOST 12.1.014-84 (1996) SSBT. Air in the area of work performed. Methodology for measuring pollutant concentrations using indicator tubes.

№	National Standards –GOSTs
11.	GOST 12.1.005-88 (1991) SSBT. General sanitary and hygienic requirements for air in the area of work performed.
12.	GOST 17.2.2.05-97. Norms and methods for measuring emissions containing the use of diesel fuel from tractors and self-propelled agricultural machinery.
13.	GOST 21393-75 Diesel vehicles. Analysis of the transparency of exhaust gases. Norms and methods of measurement.
14.	GOST 17.2.2.03-77. Concentration of carbon monoxide in the exhaust gases of vehicles with gasoline engines. Methodology of norms and measurements.
15.	GOST 17.2.2.03-87. Norms and methods of measurement of carbon monoxide in exhaust gases of vehicles with gasoline engines.
16.	GOST 17.4.2.01-81. Designations of sanitary parameters of the condition
17.	GOST 17.4.1.02-83. Classification of chemicals for pollution control.
18.	GOST 12.1.003-83 (1991) SSBT. Noise. General safety requirements.
19.	GOST 12.1.023-80 (1996) SSBT. Noise. Methods of the level of threshold noise for stationary machines.
20.	GOST 12.1.029-80 (1996) SSBT. Means and methods of protection from noise. Classification
21.	GOST 12.1.036-81 (1996) SSBT. Noise. Permissible noise levels inside residential and public buildings.
22.	GOST 12.1.007-76 (1999) SSBT. Harmful substances. Classification and general safety requirements.
23.	GOST 12.4.119-82 SSBT. Personal respiratory protection. Methods for the evaluation of protective functions for aerosols.
24.	GOST 12.4.125-83 (1985) SSBT. Collective protection against mechanical factors. Classification.
Sanitary norms and rules (SanPiN)	
25.	SanPiN 2.1.4.559-96 Drinking water. Hygienic requirements for water quality from centralised drinking water supply systems. Quality control.
26.	SN 2.2.4 / 2.1.8.562-96 Noise at workplaces, in residential and public buildings, and in the area of residence.

2.8.1 Comparison of Tajik and International Standards

68. The following tables summarise the specific standards for air quality, water, waste and noise exposure in Tajikistan compared with international guidelines and standards. In general, it can be concluded that the Tajik system in the field of environmental standards is well developed and that Tajik standards are generally broadly aligned with the standards of international financial institutions (IFIs). The most stringent standard will be applied to the project.

Table 7: Comparison of Environmental Standards for Atmospheric air

	National Standards / Requirements Standards of Tajikistan ⁶ ,	IFC / World Bank Guidelines / Standards WHO Air Quality Guidelines ⁷	EU Air Quality Standards Directive 2008/50/EC ⁸ Directive 2004/107/EC ⁹	IFC's General Recommendations on Environmental, Safety and Health (Sewage and Atmospheric Air Quality)	The accepted norms of the project (mg / m ³)	Justification
Air quality - protection of the population (for receptors)	mg / m ³ <ul style="list-style-type: none"> PM 0.15 NO 0.06 NO₂ 0.04 SO₂ 0.05 Ammonia 0.06 Benzopyrene 0.1 Benzol 0.1 Acetone 0.35 Gasoline 1.5 V₂O₅ 0.002 Phenylacetic acid 0.15 HCl 0.2 HF 0.005 Fe₂O₃ 0.04 HNO₃ 0.4 H₂SO₄ 0.1 Xylol 0.2 Manganese and its oxides 0.001 Copper oxide 0.002 	Where a number of national air quality standards are applied. If no national standards are established, then WHO standards are applied WHO guidelines, µg/m ³ : <ul style="list-style-type: none"> PM_{2.5} 10 (1 year) PM_{2.5} 25 (24 hours) PM₁₀ 20 (1 year) PM₁₀ 50 (24 hours) Ozone 100 (8 hours) NO₂ 40 (1 year) NO₂ 200 (1 hour) SO₂ 20 (24 hours) SO₂ 500 (10 minutes) 	EU Air Quality Standards, µg/m ³ (unless otherwise indicated) <ul style="list-style-type: none"> PM_{2.5} 25 (1 year) PM₁₀ 50 (24 hours) PM₁₀ 40 (1 year) NO₂ 200 (1 hour) NO₂ 40 (1 year) SO₂ 350 (1 hour) SO₂ 125 (24 hours) Lead 0.5 (1 year) CO 10 mg/m³ (8 hours) Benzene 5 (1 year) Ozone 120 (8 hours) Arsenic 6 ng/m³ (1 year) Cadmium 5 ng/m³ (1 year) 	Concentration of emissions according to the General Guidelines for Protection of Environment, Health and Safety of Vital Functions (PEHS), and: <ul style="list-style-type: none"> H₂S: 5 mg/nm³ 	mg/m ³ : <ul style="list-style-type: none"> PM 0.15 NO 0.06 NO₂ 0.04 SO₂ 0.05 CO 3.00 Ammonia 0.06 Benzopyrene 0.1 Benzol 0.1 Acetone 0.35 Gasoline 1.5 V₂O₅ 0.002 Phenylacetic acid 0.15 HCl 0.2 HF 0.005 Fe₂O₃ 0.04 HNO₃ 0.4 H₂SO₄ 0.1 Xylol 0.2 Manganese and its oxides 0.001 	Tajikistan Environmental Standards are in line with other international standards ¹⁰ The more stringent of IFC and EU standards have been used where there are no national standards for any pollutant

⁶ Annex 3 to the Environmental Impact Assessment Procedure, adopted by resolution of the Government of the Republic of Tajikistan No. 464 of 3 October 2006.

⁷ <https://www.who.int/airpollution/publications/agq2005/en/>

⁸ Directive 2008/50/EC on ambient air quality and cleaner air for Europe

⁹ Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air

¹⁰ The IFC cites the world Health Organization's guidelines for ambient air quality, generally applicable only in jurisdictions where there are no national standards.

	National Standards / Requirements Standards of Tajikistan ⁶ ,	IFC / World Bank Guidelines / Standards WHO Air Quality Guidelines ⁷	EU Air Quality Standards Directive 2008/50/EC⁸ Directive 2004/107/EC⁹	IFC's General Recommendations on Environmental, Safety and Health (Sewage and Atmospheric Air Quality)	The accepted norms of the project (mg / m³)	Justification
	<ul style="list-style-type: none"> • Magnesium oxide 0.05 • Nickel oxide 0.001 • Unlimited dust (SiO₂ 70 %) 0.05 • SiO₂ = 70 % - 20 % 0.1 • SiO₂ less than 20 % 0.15 • Lead and its composition 0.0003 • Lead sulphur 0.001 • Hydrogen sulphide, H₂S 0.008 • Turpentine 1 • Ethyl alcohol (Ethanol) 5.0 • Butyl alcohol (butanol) 0.1 • Propane alcohol (propanol) 0.3 • Methyl alcohol (methanol) 0.5 • Styrene 0.003 • Ultrafine powder 0.05 • CO 3.0 • Phenol 0.01 • Formaldehyde 0.003 • Fluoride (HF, SiF₄) 0/05 • Freon (all brands)10 • Chromium trioxide 0.0015 • Chlorine 0.03 • ZnO 0.05 		<ul style="list-style-type: none"> • Nickel 20 ng/m³ (1 year) • PAH 1 ng/m³ (1 year) <p>Additionally, Directive 2008/50/EC introduced more stringent requirements for PM_{2.5}</p> <ul style="list-style-type: none"> • PM_{2.5} 20 (3 year) - obligatory • PM_{2.5} 18 (3 year) – objective to be attained where possible in 2020 		<ul style="list-style-type: none"> • Copper oxide 0.002 • Magnesium oxide 0.05 • Nickel oxide 0.001 • Unlimited dust (SiO₂ 70 %) 0.05 • SiO₂ = 70 % - 20 % 0.1 • SiO₂ less than 20 % 0.15 • Lead and its composition 0.0003 • Lead sulphur 0.001 • Hydrogen sulphide, H₂S 0.008 • Turpentine 1 • Ethyl alcohol (Ethanol) 5.0 • Butyl alcohol (butanol) 0.1 • Propane alcohol (propanol)0.3 • Methyl alcohol (methanol) 0.5 • Styrene 0.003 • Ultrafine powder 0.05 • Phenol 0.01 • Formaldehyde 0.003 • Fluoride (HF, SiF₄) 0/05 • Freon (all brands) 10 • Chromium trioxide 0.0015 • Chlorine 0.03 • ZnO 0.05 • Ethylene oxide 0.03 	

	National Standards / Requirements Standards of Tajikistan ⁶ ,	IFC / World Bank Guidelines / Standards WHO Air Quality Guidelines ⁷	EU Air Quality Standards Directive 2008/50/EC ⁸ Directive 2004/107/EC ⁹	IFC's General Recommendations on Environmental, Safety and Health (Sewage and Atmospheric Air Quality)	The accepted norms of the project (mg / m³)	Justification
	<ul style="list-style-type: none"> Ethylene oxide 0.03 				<ul style="list-style-type: none"> Lead 0.5 (1 year) CO 10 mg/m³ (8 hours) Benzene 5 (1 year) Ozone 120 (8 hours) Arsenic 6 ng/m³ (1 year) Cadmium 5 ng/m³ (1 year) 	

Table 8: Environmental standards for water quality and discharges to water

Issue	National Standards / Requirements	IFC / World Bank Guidelines / Standards	EU Standards for water quality	Accepted standards	Justification
	Tajikistan	IFC EHS Guidelines – Wastewater and Ambient Water Quality ¹¹			
Discharge of harmful substances to the surface of the water: Treated wastewater	<p>List of MDK water quality on the surface of water bodies (requirements to water quality of fishery water bodies)¹²</p> <ul style="list-style-type: none"> pH 6.5-8.5 Aluminium (Al) 0.04 Iron (Fe) 0.1 Cadmium (Cd) 0.005 Copper (Cu) 0.001 Nickel (Ni) 0.01 Tetraethyl lead (Pb) 0.006 Zinc plate (Zn) 0.01 Chromium (Cr⁺⁶) 0.02 Chromium (Cr³⁺) 0.07 Oil and petrochemicals 0.05 White arsenic (As) 0.05 Calcium (Ca) 180 Silicon (SiO₃²⁻) 1.0 	<p>For used domestic wastewater - mg/l (unless otherwise indicated):</p> <ul style="list-style-type: none"> pH 6-9 BOD 30 COD 125 General nitrogen 10 General phosphorus 2 Oil and fat 10 TSS 50 Common coliform bacteria 400/100ml. 	<p>Standards¹³ relevant to urban sewage discharge (e.g. sewage discharge from temporary camp), mg/l</p> <ul style="list-style-type: none"> BOD 25 COD 125 Total nitrogen 15 Total phosphorus 2 TSS 35 <p>Standards¹⁴ relevant to discharges to any surface water body which are not considered potable (e.g. runoff from road construction), mg/l</p> <ul style="list-style-type: none"> Lead 0.072 (annual average) Mercury 0.00005 (annual average) Mercury 0.00007 (maximum) Nickel 0.02 (annual average) Cadmium 0.00008-0.00025 (annual average)** Cadmium 0.00045-0.0015 (maximum)** <p><i>** dependent on water hardness</i></p>	<ul style="list-style-type: none"> pH 6.5-8.5 BOD 25 COD 125 Total nitrogen 10 Total phosphorus 2 TSS 3535Common coliform bacteria 400/100 ml Aluminium (Al) 0.04 Iron (Fe) 0.1 Cadmium (Cd) 0.005 Copper (Cu) 0.001 Nickel (Ni) 0.01 Tetraethyl lead (Pb) 0.006 Zinc plate (Zn) 0.01 Chromium (Cr⁺⁶) 0.02 Chromium (Cr³⁺) 0.07 Oil and petrochemicals 0.05 White arsenic (As) 0.05 Calcium (Ca) 180 Silicon (SiO₃²⁻) 1.0 	<p>Tajik MDK is the toughest standard supplemented IFC and EU standards have been used where there are no national standards for any pollutant</p>

¹¹ <https://www.ifc.org/wps/wcm/connect/026dcb004886583db4e6f66a6515bb18/1-3%2BWastewater%2Band%2BAmbient%2BWater%2BQuality.pdf?MOD=AJPERES>

¹³ EU Urban waste water directive 91/271/EEC

¹⁴ EU Annual average EQS (2008/105/EC)

Table 9: Comparison of Environmental Standards for Waste

Issue	Tajikistan Standards/Requirements	IFC recommendations on environmental, safety and health issues	EU Standards	Accepted Project Standards	Justification
Waste treatment and disposal (Coastal part)	No numeric standards are indicated in the source documents. All generated waste must be treated and disposed of in accordance with national legislation on production and consumption waste.	There is no corresponding numeric standard.	There is no corresponding numeric standard.	There is no corresponding numeric standard.	All generated waste must be treated and disposed of in accordance with national legislation on production and consumption waste.
Secondary protective embankment (secondary containment) of liquid wastes	No numeric standards are indicated in the source documents. No numerical standards are specified in the Tajik legislation.	A secondary containment (SC) is included where liquid waste is stored in volumes of more than 220 litres. The available volume of the SC must be at least 110% of the largest storage container, or 25% of the total storage capacity (but not less).	There is no corresponding numeric standard.	There is no corresponding numeric standard.	IFC Environmental, Health and Safety Recommendations A secondary containment (VO) is included where liquid waste is stored in volumes of more than 220 litres. The available volume of the VO must be at least 110% of the largest storage container, or 25% of the total storage capacity (but not less).

Table 10: Comparison of Environmental Standards for Noise Exposure

Issue	National Standards/Requirements	International Regulations/Standards	EU Standards	Accepted Project Standards	Justification
	Tajikistan	IFC recommendations on environmental, safety and health issues EHS Guidelines – Noise Management ¹⁵			
Restriction of noise at night time for the protection of human	<p>Noise exposure at night (2300-0700) should not exceed the following levels (SanPin 2.2.4 / 2.1.8.562-96):</p> <ul style="list-style-type: none"> In residential and public buildings: <ul style="list-style-type: none"> Hotel and motels, as well as business premises: 25 dB(A); Living rooms in apartments, houses, dormitories, nursing homes and pensions, sleeping rooms in kindergartens and in boarding schools: 30 dB(A); Rooms in hotels and hostels: 35 dB(A); In residential and other areas: <ul style="list-style-type: none"> Recreation areas, adjacent hospitals and medical centres: 35 dB(A) Areas directly adjacent to residential buildings, clinics, dispensary, rest homes, homes for the elderly and disabled, kindergartens, schools and other educational institutions, libraries; 45 dB(A); Areas immediately adjacent to hotel and hostel buildings: 50 dB(A) 	<p>Noise exposure should not exceed the following levels or result in a maximum increase in background levels of 3 dB at the nearest site of the receptor outside the site:</p> <ul style="list-style-type: none"> Institution, organization, educational: <p>Night time (22: 00-07: 00): 45 dB(A)</p> Industrial, commercial: <p>Night time (22: 00-07: 00): 70 dB(A)</p> 	There is no corresponding numeric standard.	<p>Tajik standards to be applied at night time is defined as from 2300 – 0700.</p> <p>Exception 1: The IFC Standard will be valid from 2200 to 2300</p> <p>Exception 2: Territories, adjoining hotels and hostels where the IFC standard is more stringent 45 dB(A)</p>	The most stringent and provide comprehensive measures criteria

¹⁵ <https://www.ifc.org/wps/wcm/connect/06e3b50048865838b4c6f66a6515bb18/1-7%2BNoise.pdf?MOD=AJPERES>

Issue	National Standards/Requirements	International Regulations/Standards	EU Standards	Accepted Project Standards	Justification
	Tajikistan	IFC recommendations on environmental, safety and health issues EHS Guidelines – Noise Management ¹⁵			
Restriction of noise in daytime for the protection of human	<p>Daytime noise exposure (0700-2300) should not be exceeded in residential and public buildings (SanPin 2.2.4 / 2.1.8.562-96):</p> <ul style="list-style-type: none"> • Inside residential and public buildings: <ul style="list-style-type: none"> ○ wards in hospitals and sanatoriums and operating rooms: 35 dB(A); ○ Consultation rooms in clinics, clinics, dispensaries, hospitals and sanatoriums 35 dB(A). ○ Classrooms, teachers' general office, school and other conference rooms of other educational organizations, as well as 40 dB(A) public reading rooms. ○ Living quarters in apartments, rest houses, boarding houses, homes for the elderly and disabled, sleeping quarters in kindergartens, as well as residential schools: 40 dB(A); ○ Hotel and hostel rooms: 45 dB(A); ○ Halls in cafeteria, restaurants, tables: 55 dB (A); ○ Shops trading halls, passenger halls at airports and train stations, consumer services centres: 60 dB (A); 	<p>Noise exposure should not exceed the following levels or result in a maximum increase in background levels of 3 dB at the nearest receptor site outside the site:</p> <ul style="list-style-type: none"> • Institution, organization, educational: <ul style="list-style-type: none"> Daytime (0700-2200): 55 dB(A) Night-time (2200-0700) • Industrial, commercial: <ul style="list-style-type: none"> Daytime (0700-2200): 70 dB(A) Night time (2200-0700): 70 dB(a). 	There is no corresponding numeric standard.	Tajik standards to be applied at day time is defined as from 0700 – 2300	The most stringent and provide comprehensive measures criteria

Issue	National Standards/Requirements	International Regulations/Standards	EU Standards	Accepted Project Standards	Justification
	Tajikistan	IFC recommendations on environmental, safety and health issues EHS Guidelines – Noise Management ¹⁵			
	<ul style="list-style-type: none"> • Inside residential and other areas: <ul style="list-style-type: none"> ○ Recreation areas, directly adjacent hospital buildings and health centres: 45 dB (A) ○ Territories directly adjacent residential buildings, clinics, dispensary, rest homes, homes for the elderly and disabled, kindergartens, schools and other educational institutions, libraries: 55 dB (A); ○ Territories directly adjacent hotels and hostels: 60 dB (A); ○ Recreation areas on the territory of hospitals and sanatoriums 35 dB (A); ○ Recreation areas in the neighbourhoods and residential areas, holiday homes, homes for the elderly and disabled, children's playgrounds in kindergartens, schools and other educational institutions: 45 dB (A). 				

2.8.2 Standards for Vibration

69. There are no state standards for vibration in Tajikistan. However, as a permanent member of the Commonwealth of Independent States (CIS), it uses the standards developed by the CIS Council for ecology and safety at work to regulate the level of vibration:

- GOST 12.1.012-2004 Vibration safety. General requirements
- GOST 31191.1-2004 Vibration and shock. Part 1
- GOST 31191.2-2004 Vibration and shock. Part 2.

2.8.3 Compliance with established rules and regulations

70. A number of legal acts establish liability for violation of environmental laws, the enforcement of which is carried out by a number of state bodies. In particular, The law "on administrative violations" 2010. defines the administrative responsibility of organizations, their employees and citizens for a number of violations, namely, irrational and wasteful use of land resources, violation of the rules of water use or protection of water resources, or non-compliance with the requirements of the state environmental assessment. Administrative sanctions in connection with the violation of environmental norms and rules can be imposed by the commissions of Hukumats, courts, inspectors of the Committee for environmental protection, Veterinary inspection of the Ministry of agriculture, the Agency for land management, geodesy and cartography. The most typical administrative sanction is a fine of 10 minimum monthly salaries for citizens and up to 15 minimum salaries for employees and organizations. Criminal code 1998 it covers crimes against environmental safety and the environment, in particular, violation of environmental safety at work, poaching, soil pollution, violation of the rules of protection and use of underground resources. The maximum fine is up to 2,000 minimum wages and the maximum sentence is up to 8 years in prison.

2.9 National Environmental Programs

2.9.1 State Environmental Program (2009 to 2019)

71. The program, approved in 2009, calls for the adoption of modern environmental standards for water, air, soil, solid waste, toxic waste, as well as noise control, to the maximum extent allowed. Standards must be accompanied by emission allowances.
72. The program also provides for more effective monitoring, improved environmental impact assessment, and improved funding for environmental protection measures.

2.9.2 Concept of Environmental Protection in Tajikistan

73. The concept adopted in 2008 leans upon the principles of implementation of environmental issues in various aspects of the economy, the use of international standards for the creation of environmental management systems, protection and rational use of water and land resources.

2.10 Regulatory Framework for Land Acquisition and Resettlement

2.10.1 Overview

74. In the legislation of Tajikistan, there is no special law or policy, which regulates the issues of resettlement and/or land acquisition or expropriation of rights to land and immovable property for state or public needs. Moreover, there is no separate law that completely provides norms and mechanisms for the

determination of the full and fair, market value of land. The key legislative acts regulating land management relations and the ownership rights to immovable properties in the Republic of Tajikistan are the following:

- Constitution of the Republic of Tajikistan (1994, as amended in 2003)¹⁶
 - Land Code (amended in 2012)¹⁷
 - Land Code (amended in 2008)¹⁸
 - Civil Code (amended in 2007)¹⁹
 - Regulation “about compensation of losses to the land users and losses of agricultural products” (approved by the Decree of Government of Republic of Tajikistan, 2000. № 515)²⁰
75. The Constitution of the Republic of Tajikistan, Land Code and the Civil Code of the Republic of Tajikistan are the fundamental laws on which the legislation is based. The framework for the Project is based on the ADB SPS 2009 requirements and applicable laws, regulations and policies. Where differences exist between local law and ADB policies and practices, the resettlement for this Project will be resolved in favour of the latter.

2.10.2 Types of Land Ownership and Land Use Rights Allocation

76. All land is owned by the Republic of Tajikistan, which is responsible for its effective use. Several tenure options for agricultural land are defined by the Land Code. There are primary use rights and secondary use rights. Primary use rights include the following:
- Perpetual use which has no fixed term. It is granted to legal entities such as state and cooperative agricultural enterprises, public and religious organizations and charities, industrial and transportation needs, public enterprises, defence and joint ventures that include foreign entities.
 - Limited or fixed-term use may be granted to legal or physical persons for either a short-term (up to 3 years) or long-term (3 to 20 years).
 - Life-long inheritable tenure which may be assigned to physical persons or collectives. Physical persons must re-register the right in the case of inheritance. This right applies to land-shares used to organise a dekhan farm, as well as household (garden) plots.
77. The only secondary use-right recognised under the Land Code is the right to lease. According to the Code, primary rights holders may lease out their plots for a term not exceeding 20 years. The land is used in accordance with the state-established land-use standards. The right to use land may be terminated for various reasons such as: termination of activities by the land user, non-use for two years and use of the land differing from the use established in the use-rights document. (Land Code Article 37)
78. Dekhan land is the result of the splitting up of large state-owned farm enterprises, known as kolkhoz and sovkhoz farms, which were established

¹⁶ Constitution, November 6, 1994, as amended on 22 June 2003.

¹⁷ Land Code of the Republic of Tajikistan as amended on 01 August 2012

¹⁸ Land Code, as amended by N 498 from December 12, 1997., N 746 from May 14, 1999, N 15 from May 12, 2001, N 23 from February 28, 2004. From 28.07.2006 №199, from 5.01.2008 №357, from 18.06.2008 №405.

¹⁹ Civil Code, as amended by August 6, 2001, N 41; May 3 2002 №5, March 1, 2005, N 85; April 29, 2006 №180, May 12, 2007. №247).

²⁰ Approved by the Decree of Government of Republic of Tajikistan, December 30, 2000. №515.

throughout much of the former Soviet Union. Sovkhoz farms were run by the state, while kolkhoz farms were a form of co-operative farm, run by a committee of members approved by the state. The Agrarian Reform Program in Tajikistan was adopted for the period of 2012-2020. Creation of Dehkan farms is one of the priority areas of land reform. The basis for creating Dehkan farm in the Republic of Tajikistan is defined by the Law “On Dehkan farms”²¹, №48 of 10 May 2002. It resulted in the creation of 31 Dehkan farms in 1992 with 300 hectares of land. In 2003, there were 16,433 registered Dehkan farms with 240,100 hectares²².

79. In dekhkan farms, the land remains state property (which cannot be bought or sold), but farmers are granted inheritable land use rights which give complete legal freedom to landholders to manage the land as they desire. The state collects taxes and can repossess the land if it believes the land is not being managed properly. There are three types of dekhkan land: individual (the land use certificate is held by an individual), family (the certificate is jointly held) and collective (the certificate details common property shareholders).
80. A collective Dehkan consists of two or more unrelated families, producing and marketing jointly. Dekhan farm —associations, or —associative dekhkan farms, operate in a similar manner to collective Dekhans, although the families involved technically have their own Dekhans and work together cooperatively. Both family and collective Dehkans operate by appointing a head who officially holds the farm’s land registration certificate and legally represents the interests of the farm (Duncan 2000; GOT 2008; ARD 2003; Robinson et al. 2009; GOT 2009a).
81. Presidential land is similar to dekhkan land. It was allocated in small plots to private households in the late 1990s by Presidential Decree. The essential difference between dekhkan and Presidential land is that no land-use rights certificate is required for the latter land plots (they are registered at the jamoat level per household).
82. Reserve Fund land usually consists of unused land. It also includes land plots for which land use rights have been abandoned. State reserve land is at the disposal of the district administrations and is rented out or distributed for individual agricultural cultivation purposes. Article 100 of the Land Code states that State land stock is reserved for the agricultural, industrial, transport and other needs of the national economy.
83. Supported Farms land includes land provided to different government institutions as assistance to their members and employees. The land is given to employees who did not get any land under other government schemes.

2.10.3 Tajikistan Constitution, Law / Regulation on Land Acquisition, Resettlement and Compensation

84. The Constitution of the Republic of Tajikistan is the main legal document which guarantees citizen’s rights. Article 13 states that land, bowels of the earth, [i.e. mineral resources], water, airspace, animal and vegetable kingdoms, [i.e. flora and fauna], and other natural resources are owned by the state, and the state

²¹ Law of the RT “On Dehkan farms”.2002. www.mmk.tj

²² Source: Statistical Yearbook of the Republic of Tajikistan. 2001. Statistical Agency. Dushanbe, 2001, c.175. Statistical Yearbook of the Republic of Tajikistan. 2004. Statistical Agency. Dushanbe, 2004, c.173.

guarantees their effective use in the interests of the people. Furthermore, Article 12 states that the economy of Tajikistan is based on various forms of ownership and the state will guarantee freedom of economic activity, entrepreneurship, equality of rights, and the protection of all forms of ownership, including private ownership.

85. The legal basis for state acquisition of private property for public works is outlined in Article 32 which states “...the property of an individual is taken away only on the basis of the law, with the consent of the owner and to meet the requirements of the state and society, and with the state paying full compensation.”

2.10.3.1 Provisions regulated by the Land Code

86. In August 2012 amendments to the Land Code that enable legal sales and lease transactions for land use rights were approved.²³ The Land Code also includes changes to the provisions related to land acquisition.²⁴
87. The revocation/allotment of lands and resettlement envisages compensation for losses incurred by land users or those with other registered rights to the land when the land plot is revoked for state and public needs.
88. The state may revoke land plots for state and public needs from land users after:
- allocating a land plot of equal value;
 - constructing housing and other buildings with the same purpose and value, in a new location for the natural persons and legal entities to whom the land plot had been allocated, in accordance with established procedures;
 - fully compensating for all other losses, including lost profits, in accordance with the legislation of the Republic of Tajikistan.
89. Upon the revocation of land plots for state and public needs, all losses shall be calculated according to the market price, which shall be defined by taking into consideration the location of the land plot, and compensation shall be paid to the persons/legal entity whose land has been taken away. Termination of the right to use a land plot, for state and public needs, can be carried out after allocation of an equal land plot and compensation of other expenses is provided by part one of the present article. (L.C. Article 41; In the Republic of Tajikistan Law edition dated 1 August 2012, No. 891).
90. The procedure for the compensation of losses to land users and losses arising from the removal of land from circulation is regulated by Article 43 of the Land Code edition dated 1 August 2012, No. 891:
- In the event of revocation of a land plot for state and public needs, compensation for losses to land users and others with registered rights to the land, and losses connected to the removal of land from circulation, shall be made by the natural/legal persons whose activity led to the revocation.
 - In the event of withdrawal of a land plot for state and public needs, the procedure for compensation of losses to land users and others with registered rights to the land, and losses connected to the removal of land from circulation,

²³ Law 891, dated August 2012, article 19.

²⁴ Articles 37-45

shall be defined by the Government of the Republic of Tajikistan (In RT Law edition dated 5 January 2008, No. 357).

- Upon termination of the rights to a property, the property will be assessed based on its market value (Article 265 Civil Code).
- Land users should be notified in writing about land revocation by the local executive government body no later than one year before the pending withdrawal of the land (Article 40. Land Code of the Republic of Tajikistan Law edition dated 1 August 2012 no. 891).
- In the event that international agreements recognised by the Republic of Tajikistan establish other rules than those contained in the Land Code of the Republic of Tajikistan, the rules of the international agreement shall be applied (Article 105, LC of the RT edition dated 28 February 2004 No. 23).
- The Land Code of 1997 is the core legal document related to land acquisition. It has been updated a few times and most recently in August 2012. Article 2 of the Land Code states that “land is an exclusive ownership of the State... [but]... the State guarantees its effective use in the interests of its citizens”. However, Articles 10-14, the Land Code outlines land title as being of long-term, short-term, and inherited land use entitlement. Article 14 of the LC of the RT also states that land users may lease land plots by agreement (In the Republic of Tajikistan Law addition dated 1 August 2012 No. 891).
- Article 24 of the Land Code describes the allocation of land for non-agricultural purposes, and provides that when choosing a suitable location for such land uses, land not suitable for agriculture should be favoured. The same principle is stressed by Article 29, which discourages the use of high-yielding agricultural land for non-agricultural use. However, Article 29 also allows for allocation, and appropriating of agricultural land for “*other very important State objects*”.

91. In accordance to Article 19 of the Land Code, the land right users may:

- execute civil-legal transactions (buying-selling, gift, exchange, mortgage and other) with allocated (acquired) use right to a land plot with a right to alienate it independently without interference of executive government bodies, except for provisions of present Code; (In the Republic of Tajikistan Law edition dated 1 August 2012 No. 891)
- lease the land plot;
- establish private (based on consent) servitude to a land plot; (In edition dated 1 August 2012 No. 891)
- mortgage the right to a land plot;
- receive compensation in the event of withdrawal of the right to use the land plot for state and public need in accordance with Article 41 – 43 of the present Code.

92. Compensation for land which belongs to the State but is allocated and essentially leased to users by each hukumat, is divided between the hukumat and the user according to the following proportion:

- 40 % to the hukumat, which will no longer derive income from taxes and leases for the portion of the land being acquired
- 60% to the land user, who suffers a reduction in his/her income-generating asset.

93. The compensation received by the hukumat is used for the management, construction, and maintenance of local infrastructure. The land user also

receives compensation for lost crops based on the provisions outlined in the Entitlement Matrix.

2.11 Tajikistan Law / Regulation on Labour, Health and Safety

2.11.1 Law on Industrial Safety of Hazardous Production Facilities (2004)

94. This Law is aimed at ensuring the safe operation and preventing accidents at hazardous production facilities, ensuring emergency preparedness of organizations operating hazardous production facilities including their ability to localise and eliminate the consequences of these accidents, to ensure compensation for damages caused by accidents to individuals and legal entities, the environment and the state.

2.11.2 Labour Code (2016)

95. This Code regulates labour relations and other relations directly related to them, aimed at protecting the rights and freedoms of the parties to labour relations, establishing minimum guarantees of rights and freedoms at work.

3 Description of the Project

3.1 Project Components

96. A national design consultant has been appointed²⁵, they have: reviewed the existing alignment; carried out geotechnical testing and produced a design that, mainly, follows the existing alignment. It restores areas where earthslips have occurred, cutting back slopes to a stable angle where slips have occurred and building, strengthening or replacing bridges and the design requirements for tunnel sections. The review also concluded that an additional (third) 2.6 km tunnel was needed to remove a high level tightly curved mountain section.
97. The design speed of the road is 50 kph due to the road being predominantly in mountainous terrain, this is in line with the specifications for Class III roads. On the sections of which are in rolling or flat terrain, the national speed limit of 90 km/h will apply. There are also sections where lower speed limits than 90 km/h will be applicable, and these will be indicated with signage as follows:
- Approaches to villages – 40 km/h (advisory speed limit)²⁶
 - Sharp bends – 50 km/h (advisory speed limit)
 - Tunnels – 40 km/h (advisory speed limit)
98. In addition to the construction activities on the road there are other works and activities associated with the development of the alignment. These include:
- Borrow areas (quarry sites) – bulk earthworks were carried out in the soviet era the new works will remediate erosion effects and construct the engineered sub base, and asphalt layers. Excess spoil and rock can be used in the reconstruction process, so new borrow areas may not be required, or will be of limited number;
 - Storage areas for excess spoil – The re-engineering of slopes and embankments will generate quantities of spoil and the tunnel sections will generate rock material. The location of temporary and permanent spoil storage and disposal areas will need careful consideration;
 - Manufacturing / processing area(s) for concrete, asphalt and rock crushing / grading;
 - Construction camps (offices, storage, maintenance and accommodation);
 - Site construction access routes to bring plant and materials to site; and
 - Village access roads to permit permanent access to the alignment from villages.
99. The following figures and sketches show the plan and schematic of the proposed works. Figure 5 is a location plan for the project.

²⁵ Avtostrada (Tajikistan)

²⁶ This may be made mandatory subject to approval by the Ministry of Transport and the Tajikistan Traffic Police

Figure 5: Plan of Works –North section is new alignment (South is existing alignment)



100. Figure 6 is a schematic showing distances along the alignment and the key engineering elements (tunnels and bridges).
101. The seventeen acknowledged villages that the alignment passes through are indicated in Figure 7 schematic. The position of the orange village marker indicates if the village is passed by on the uphill (generally northside) or downhill (generally southside). Exceptions are at Kandak (Village 3 km 4 to 6), Komsomolobod sub rayon (km 68 to 69) and Gulmon (km 72) where the alignment will cut through villages. At some of the intermediate river valleys (km 26, 28, 49, 53 and 57) the alignment crosses over village development on bridge structures.

Figure 6: Schematic of alignment showing distance along alignment, tunnels & bridges

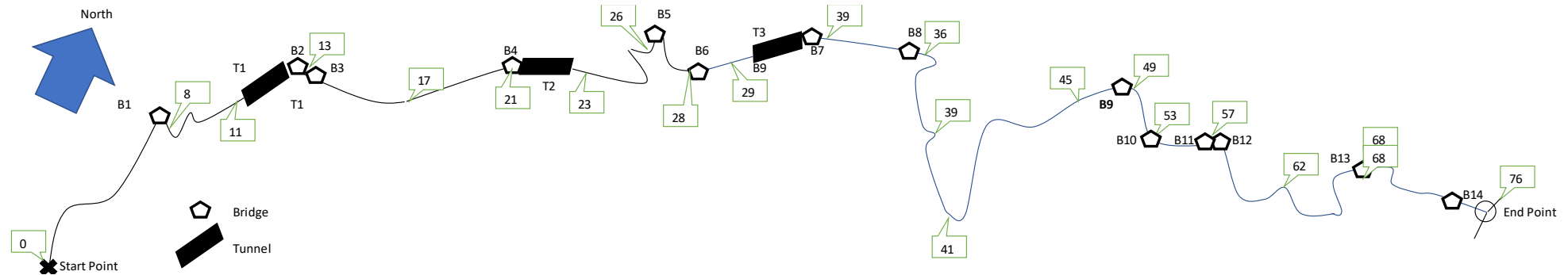
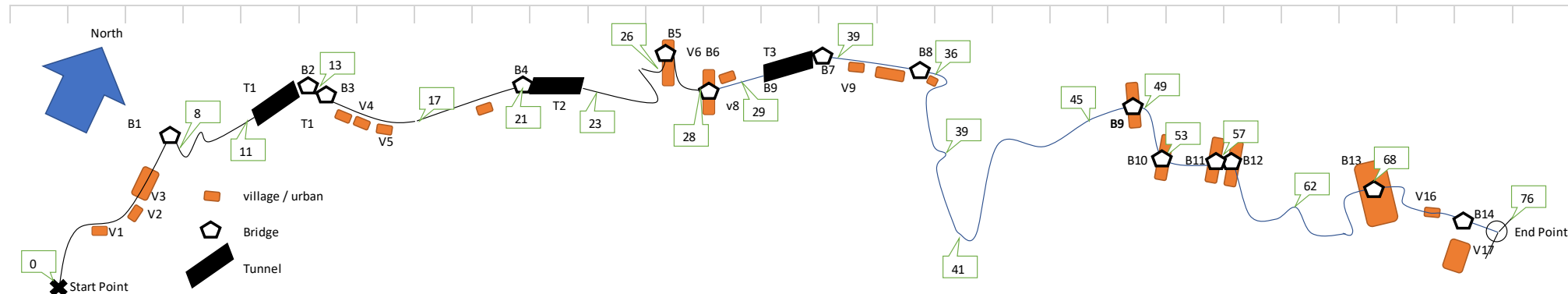


Figure 7: Schematic of villages on the alignment



102. The status of the villages is set out in Table 11.

Table 11: Schedule of acknowledged villages on the alignment

	Km (approx)	Rayon / District (Hukumat)	Sub Rayon / District (Jamoat)	Village (Mahala)	Other Notes
1	2	Rogun (Рогун)	Obigarm (Обигарм)	Bozorak (Бозорак)	Pass by to left
2	3			Labijar (Лабичар)	Pass by to left
3	4-6			Kandak (Кандак)	Pass through
4	15	Nurabad (Нуробод)	Sicharog (Сичарог)	Sh. Aslon (Ш. Аслон)	Pass by to left
5	16			Dehi Alisho (Дехи Алишо)	Pass by to left
6	26		Hakimi (Хакими)	Javji Royn (Чавчи Поён)	
7	28			Sadoqat (Садокат)	
8	29			Siyhgulak (Сияхгулак)	
9	35		Mujaharf (Мучахарф)	Chepak (Чепак)	
10	36			Mujaharfi kalon (Мучахарфи калон)	
11	49		Komsomolobod (Комсомолобод)	Degay (Дегай)	
12	53			Tutkhor (Тутхор)	
13	57			Bulbuldara (Булбулдара)	Pass through
14	58			Tegermi (Тегарми)	Pass through
15	68			Pandovchi (Пандович)	Pass through
16	72		Safedchashma (Сафедчашма)	Gulmon (Гулмон)	Pass through
17	76		Darband (Дарбанд)	Darband town	

Source: Information from the Social Safeguards Team (ADB consultants and PIURR), during on-site consultations (August 2018) and LARP (Dec 2018)

3.2 Packaging of the Project

103. The project will be competitively tendered as three separate bid packages:

- Package 1: Obigarm - Tagikamar km 0 – km 30 +217: Includes 2 tunnels (Kandak and Karagach), 4 new bridge constructions and 2 bridge rehabilitations, and local access roads of approximately 30 km;
- Package 2: Tagikamar-Nurobod km 30 +217– km 75 +600 (less the section for Package 3 which runs from km 72+900 to km 74+303): Includes Tunnel 3 (Tagikamar), 6 new bridge constructions, 1 bridge rehabilitation and one road diversion with a new temporary bridge at Darband, and local access roads of approximately 40 km; and
- Package 3: km 30 +217 - Long Bridge at Darband: The permanent bridge will be approximately 760m long, and is needed to cross the Surkhkhob River at the east end of the alignment. It will be awarded as an “Employer Design” contract.

3.3 Construction Camps and Operational Maintenance Depots

104. There are no existing facilities on the alignment that can be reused or hired to construct the works and the Contractor will need to bring onto site all plant, machinery and materials for the works as well as buildings and ancillary elements to provide offices and accommodation, as well as staff to provide the management, skilled, semi-skilled and labour functions for construction. Most workers will need to be accommodated in construction camps with associated sleeping accommodation, recreation facilities, water supply, toilets, electricity, waste collection and disposal. Effectively, self-contained villages (construction camps for workers) will be needed on, or close to the alignment, for the duration of the project.

105. There will be some opportunity for local employment in the semi-skilled, labour and administration roles and national employment in skilled, semi-skilled, labour and administration categories. A minimum of 50 % of the workforce should be locally sourced where feasible, and contracts for each package will stress that the Contractor should consider use of local staff where appropriate. It is anticipated that the proportions for the Project will be closer to 80% local vs 20% international. Participation of women in the workforce will also be promoted.
106. The discontinuous nature of the existing alignment (no through passage at the proposed tunnel sites) means that separate camps will be needed between the tunnel sections. Table 12 indicates how a system of camps could be operated based on the split of the three construction contracts, the aspects of the project served and the potential impacts from Construction Site Access Roads. These locations are indicative for the purposes of impact assessment in this report; the contractors will be responsible for developing, operating, and removing the camps, workshops and other facilities they will need to construct their respective contracts. It is estimated that approximately 1,100 construction workers will be engaged in activities for Packages 1 and 2, including all activities (road construction, tunnelling, bridge works, concrete production, support services, etc.).

Table 12: Indicative Locations of Construction Camps and Construction Elements Served

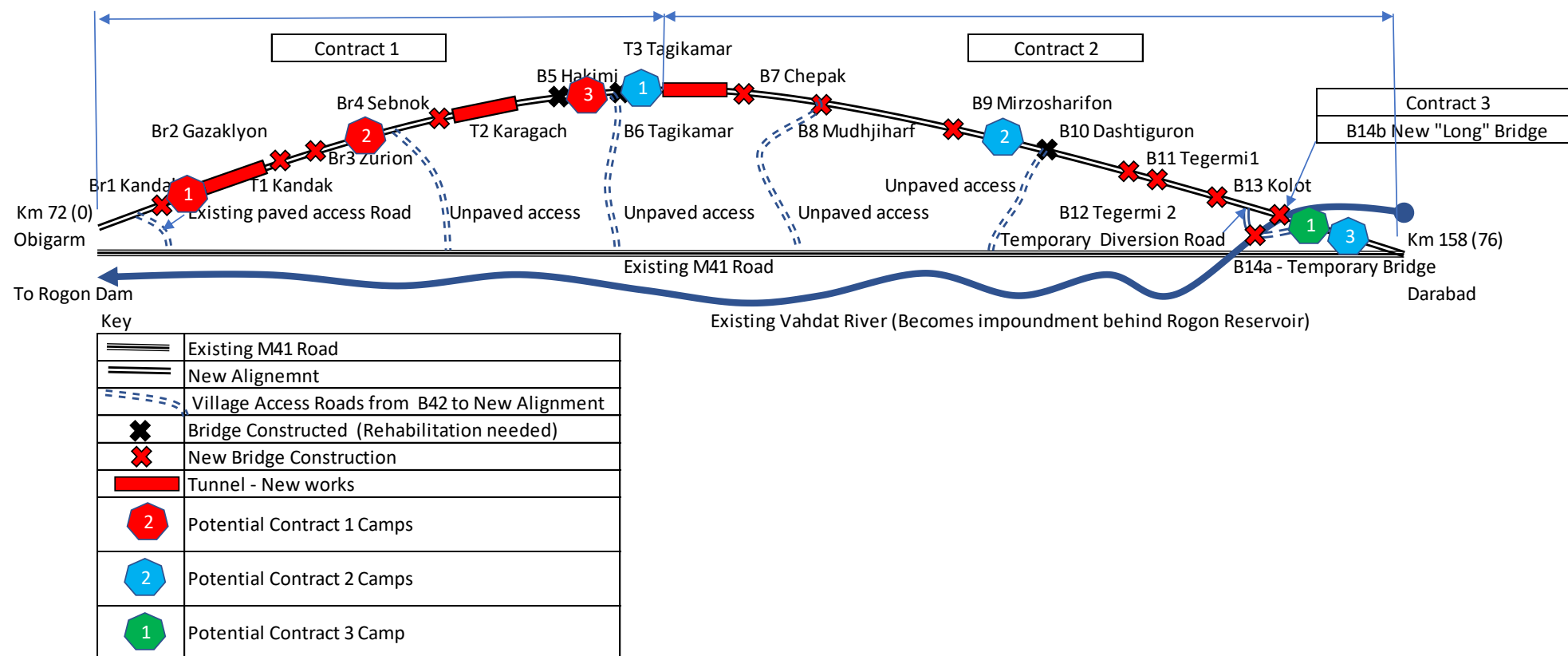
	Camp	Serving	Construction Site Access Road	Notes
Contract 1	1/1	<ul style="list-style-type: none"> Km 0 to Tunnel 1 (W) portal Tunnel 1 portal 	From Obi Garm along alignment	Limited impacts on access
	'1/2	<ul style="list-style-type: none"> Tunnel 1 (E) portal to Tunnel 2 (W) portal Tunnel 1 - E Portal Tunnel 2 – W Portal 	On existing unpaved Road from M41	Potential impacts on village communities adjacent to the unpaved road (traffic noise, dust generation, road safety)
	'1/3	<ul style="list-style-type: none"> Tunnel 2 (E) to Tunnel 3 (S) Tunnel 2 – E Portal 	On existing unpaved Road from M41	
Contract 2	2/1	<ul style="list-style-type: none"> Tunnel 3 S Portal 	On existing unpaved Road from M41	Generally access is off existing paved roads
	2/2	<ul style="list-style-type: none"> Tunnel 3 N Portal to point to be determined Tunnel 3 N Portal 	On existing unpaved Road from M41	
	2/3	<ul style="list-style-type: none"> Point to be determined to end of alignment (km 76) Temporary Crossing including Bailey Bridge 	From existing M41 Road	
Contract 3	3/1	<ul style="list-style-type: none"> Long Bridge Construction 	From existing M41 Road	

Note 1) Camp locations are indicative, identified for the purposes of impact assessment. The Contractor is responsible for the identification, development, operation and decommissioning of camps.

Note 2) It is assumed that each tunnel will be driven from each portal i.e. two working faces.

107. Figure 8 is a schematic illustration of how location and access to camps could proceed, although the final decision on number of camps and their location will rest with the Contractor, who will need to enter into leasing land from owners, and consider the environmental and social impacts of the chosen locations.
108. Prior to establishment of camps, the environmental and social impacts of each will be assessed and appropriate measures will be developed and implemented to mitigate environmental and social impacts. Locations will be selected to minimise impacts to the extent practicable.
109. It is anticipated that one or more of the construction camps will be retained following completion of the Project, and used as operational maintenance depots during the operation of the road.

Figure 8: Indicative Locations for Construction Camps on the Alignment



Note 1) Camp locations are indicative, identified for the purposes of impact assessment. The Contractor is responsible for the identification, development, operation and decommissioning of camps, and consideration of their environmental and social impacts.

Source: This EIA

110. Prior to construction of the long bridge across the reservoir / Surhkhub River (Package 3), a temporary bridge will be installed (as part of Package 2) at the east end of the alignment. This will be a prefabricated “Bailey” bridge 7 m wide and 125 m long, with three spans supported by a two piers. Piling works will be required in the river to install the support piers. The bridge, and associated construction camp, will be located approximately 1.25 km from the nearest village.

3.4 Permanent Long Bridge

111. A permanent bridge will be constructed above the temporary bridge during Package 3 of the Project and will be awarded as an “Employer Design” contract. The dimensions of the permanent bridge will be approximately 760 m long and 11.5 m wide.

3.5 Access Roads

112. Two types of road providing access to the alignment will be developed. These are:

- Site construction access routes - these will be **temporary access roads** to the alignment for use by construction traffic during the construction period.
- Village access roads – these will be **permanent access roads**, connecting villages to the alignment.

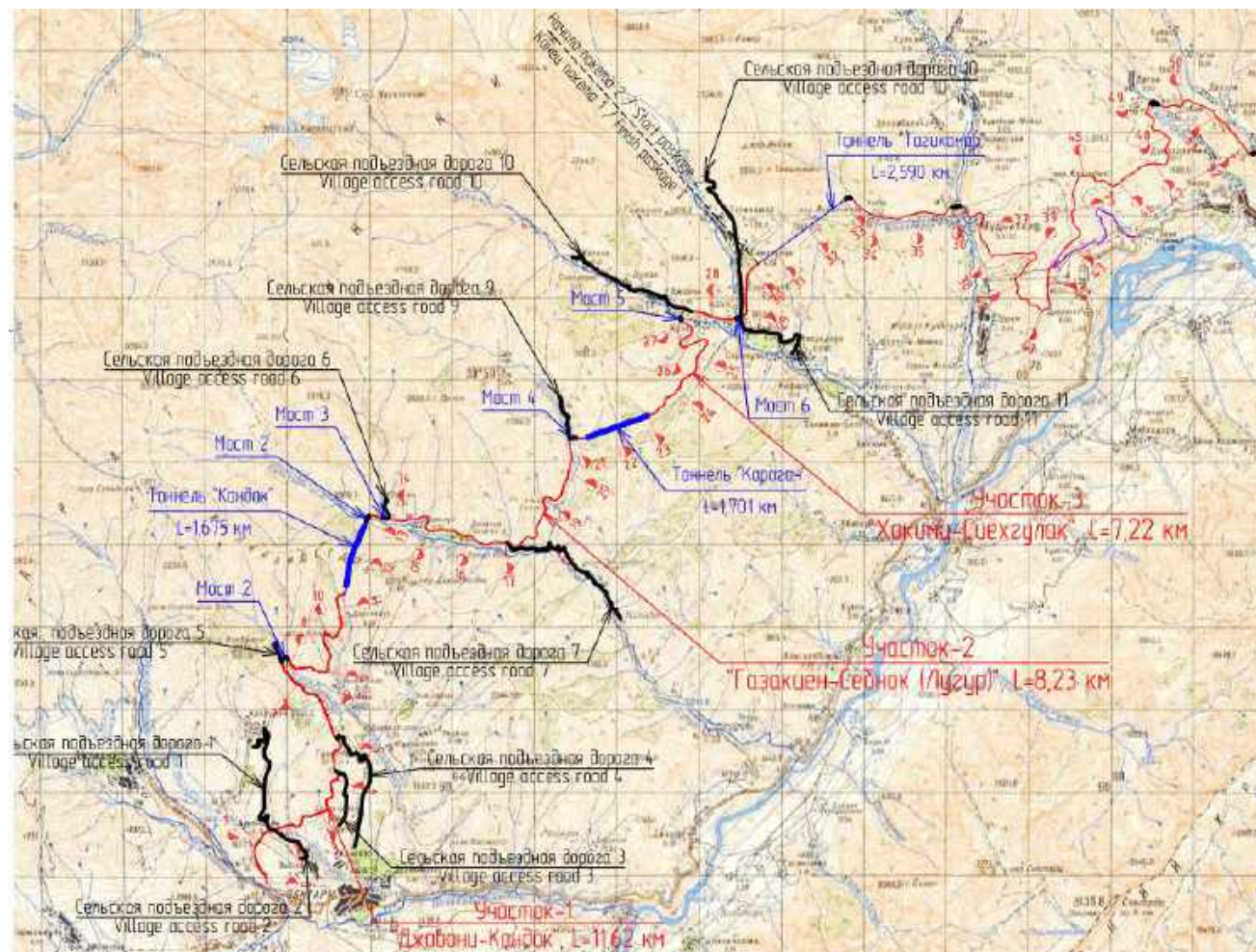
113. 30.25 km of village access roads are proposed for Lot 1, and 44.5 km for Lot 2. The proposed locations of the village access roads for Lots 1 and 2 are shown in Figure 9 and Figure 10 and summarised in Table 13.

114. A supplementary impact assessment of the proposed village access roads in Lot 1 has been carried out and is included in this EIA as Annex 9: Community Access Roads – Rehabilitation Works. This assessment included site visits, consultation with stakeholders, environmental impact assessment and land acquisition / compensation issues. The existing access roads are a MOT administered right of way (RoW) and there are no registered land and property rights within the RoW. Some fruit trees encroach into the RoW and these have been identified and owners will be compensated for loss²⁷. A road safety audit²⁸ for the main alignment included assessment of road safety considerations at the junctions between the alignment and the permanent access roads.

²⁷ There are 241 affected trees (age 3 to 50 years) and 491 shed trees and bushes (age 3 to 15 years). See Table 2 of the Community Access Roads – Rehabilitation Works document in Annex 9 of this EIA.

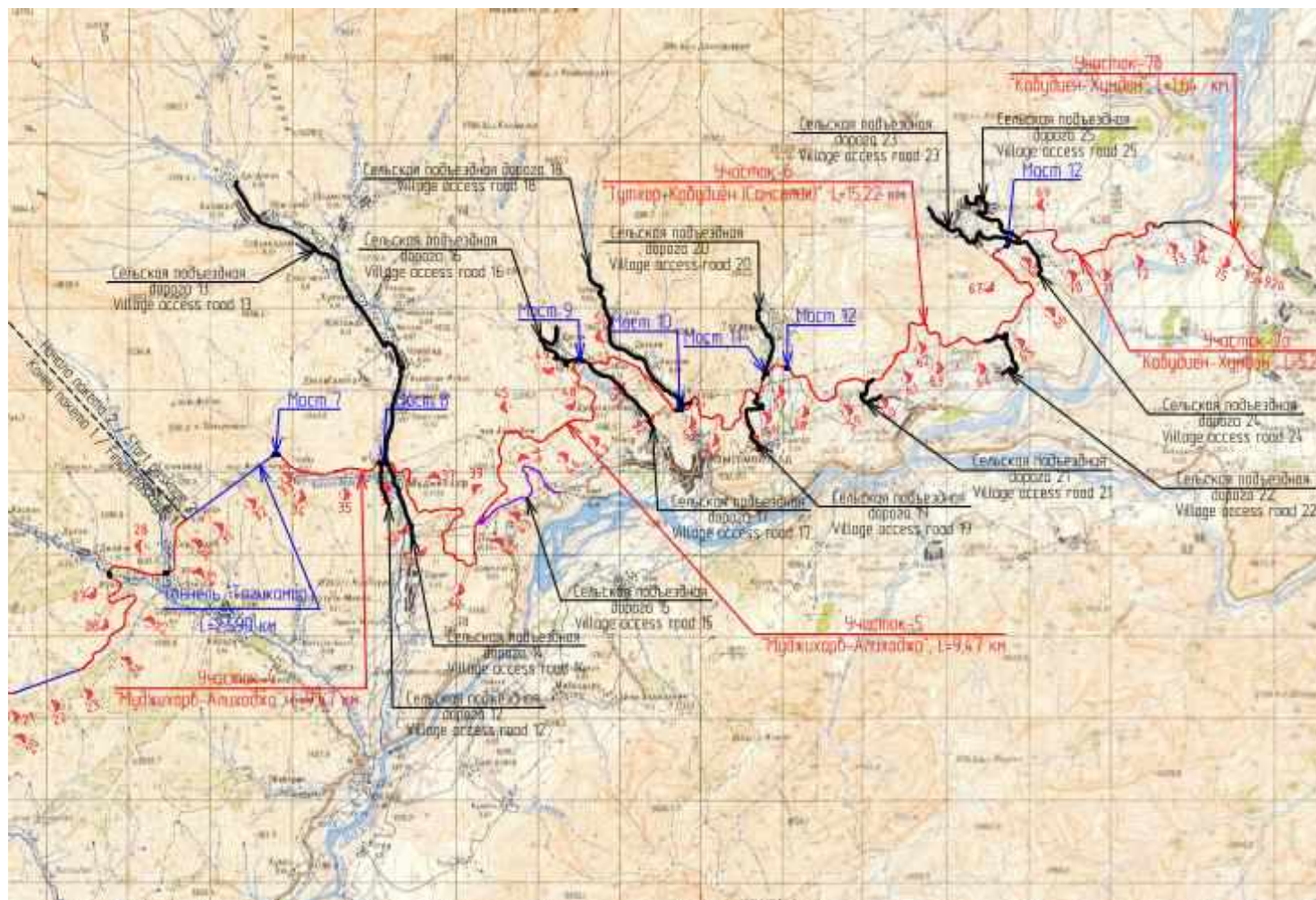
²⁸ Detailed design stage road safety audit report for the proposed Obigarm-Nurabod Highway, northern Tajikistan, Road Safety International

Figure 9: Proposed locations of village access roads (Lot 1)



Source: Avtostrada Drawing no 16-16-AD-DR.01, Vahdat-Rasht-Jirgital-Kyrgyzstan border road (from km 72 to km 158)

Figure 10: Proposed locations of village access roads (Lot 2)



Source: Avtostrada Drawing no 16-16-AD-DR.02, Vahdat-Rasht-Jirgital-Kyrgyzstan border road (from km 72 to km 158)

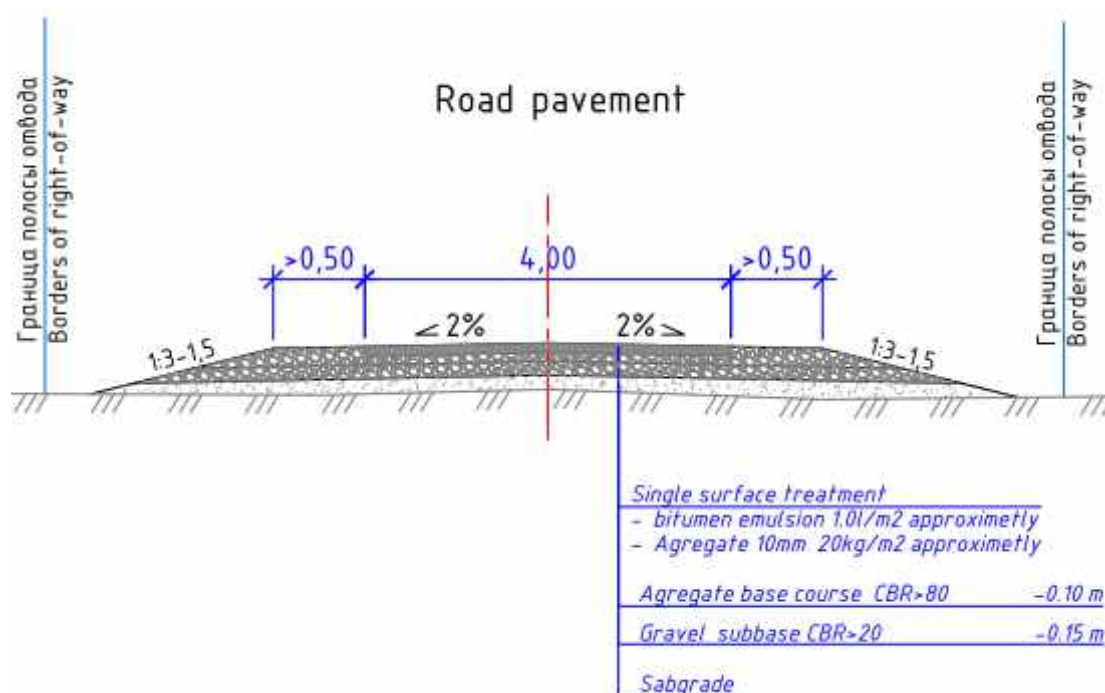
Table 13: Village access roads- Villages served and length of road

No	Package / Lot	Village name	Location from the main road	Length, km
1	Lot 1	Kukabulok	To the left	3.95
2		Eshonon	To the right	1.25
3		Eshonon	To the right	3.30
4		Kandak	To the right	3.80
5		Kandaki bolo	To the left	0.75
6		Gazakiyon	To the left	0.65
7		Dialisho	To the right	4.65
8		Sebnok	To the left	1.45
9		Chavchi (Hakimi)	To the left	3.65
10		Tagikamar 1	To the left	3.60
11		Tagikamar 2	To the right	3.20
TOTAL LOT 1				30.25
12	Lot 2	Mujiharf	To the right	1.35
13		Degdonac	To the left	9.60
14		Mujiharf	To the right	1.85
15		Ayni access road	To the right	3.70
16		Mirzosharifon	To the left	2.25
17		Sebak	To the right	2.85
18		Tukhor	To the left	4.90
19		Sunjit	To the right	1.80
20		Tegermi	To the left	2.00
21		Sanipul	To the right	1.85
22		Safedchashma	To the left	1.95
23		Ulfatobod 1	To the left	2.89
24		Ulfatobod 2	To the left	1.30
25		Sherbigiyon	To the left	2.75
26		Brick factory	To the right	3.80
TOTAL LOT 2				44.8

Source: Avtostrada Drawing nos 16-16-AD-DR.01 & 16-16-AD-DR.02, Vahdat-Rasht-Jirgital-Kyrgyzstan border road (from km 72 to km 158)

115. The proposed construction dimensions for the village access roads are presented in Figure 11.

Figure 11: Typical dimensions of village access roads



Note: All dimensions in metres

Source: Avtostrada Drawing nos 16-16-AD-DR.01 & 16-16-AD-DR.02, Vahdat-Rasht-Jirgital-Kyrgyzstan border road (from km 72 to km 158)

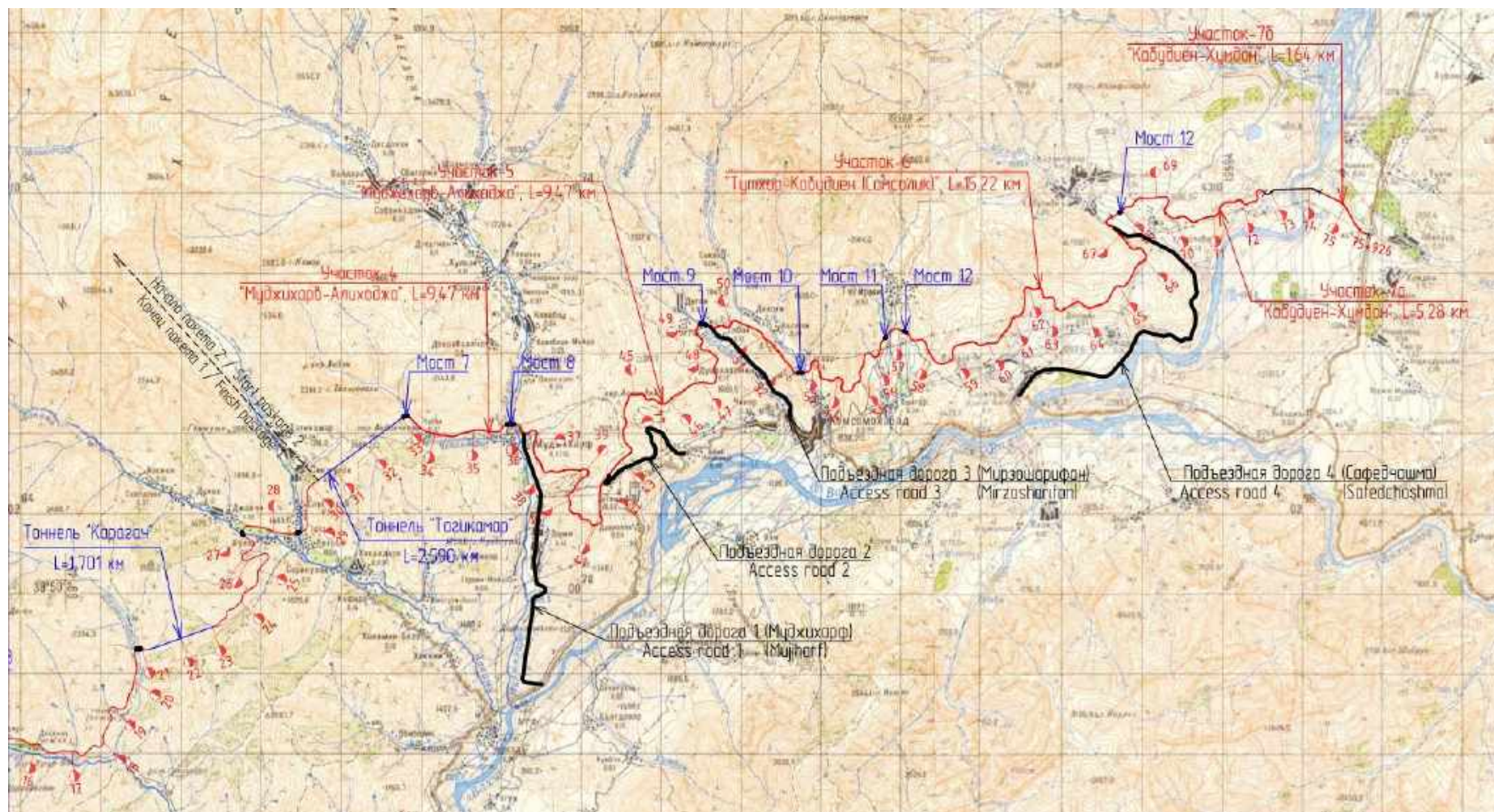
116. The proposed locations of the site construction access routes are shown in Figure 12 and Figure 13.

Figure 12: Proposed location of site construction access routes (Lot 1)



Source: Avtostrada Drawing no 16-16-AD-DR.01, Vahdat-Rasht-Jirgital-Kyrgyzstan border road (from km 72 to km 158)

Figure 13: Proposed location of site construction access routes (Lot 2)

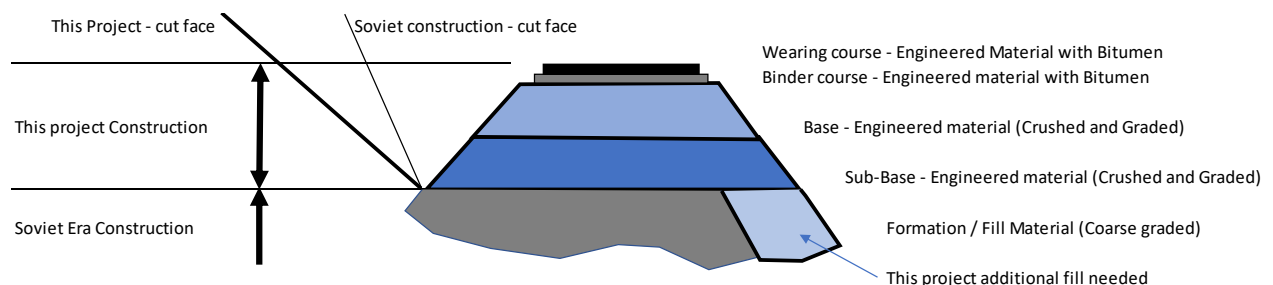


Source: Avtostrada Drawing no 16-16-AD-DR.02, Vahdat-Rasht-Jirgital-Kyrgyzstan border road (from km 72 to km 158)

3.6 Basic Road Construction

117. A road is formed in a number of layers with the upper layers requiring increasing levels of material processing i.e. crushing and grading (with potential for adverse dust and noise impacts). The lowest layer is the “formation” and requires minimal material processing – this is the stage of construction partially existing from the Soviet era. The objective is to form a stable level base to build on. The next two layers are the “sub-base” and “base” courses. These layers are constructed from rock / stone that has been crushed and graded before being placed and compacted with a heavy roller. The upper two layers are the “binder course” and the “wearing course”, which the vehicles run on. These layers are of finer material mixed with bitumen to bind, seal and give a smooth running surface. Road construction standards have changed since the Soviet era and the current design will need to widen the formation (requiring additional fill) and further cutting of slopes to a more stable angle (generating potential fill material). Figure 14 shows the typical road cross section for this project.

Figure 14: Typical road cross section showing processing requirements



Source: This EIA

118. The road has been designed in accordance with State Standard (GOST) 33475-2015²⁹, adopting the specifications prescribed for Category III roads. These are summarised in Table 14.

Table 14: Technical Parameters for Class III Roads

Design traffic speed	50 km/h
Number of lanes	2*
Width of lanes	3.5 m
Width of carriage ways	7.0 m
Width of shoulders	2.5
Minimum width of hard shoulders:	1.5 m
• including margin course	0.5-0.75 m
Smallest horizontal curve radius in plan	50 m**
Greatest longitudinal slope	100%***
Smallest vertical curves:	
• cambered	1,500 m
• saddle like	400 m
Road surface	permanent type
Type of loading for artificial structures	A14 and H14
Pavement load	115 kH

* In sections with a protracted inclines (over 70 %) an additional lane in the uphill direction is provided for the movements of freight transport.

** According to the norms of road design of the Asian Highway network.

²⁹ State Standard (GOST) 33475-2015²⁹: Public Roads; Geometric Elements; Technical Requirements

*** According to minutes of technical Meetings

119. During construction, additional working width will be required to allow construction activities to proceed affectively. The construction width will range from 12 m where access is highly restricted, to a maximum of 120 m in some locations.

3.7 Project Resource Usage

120. The Project will use resources, including the following key resources:

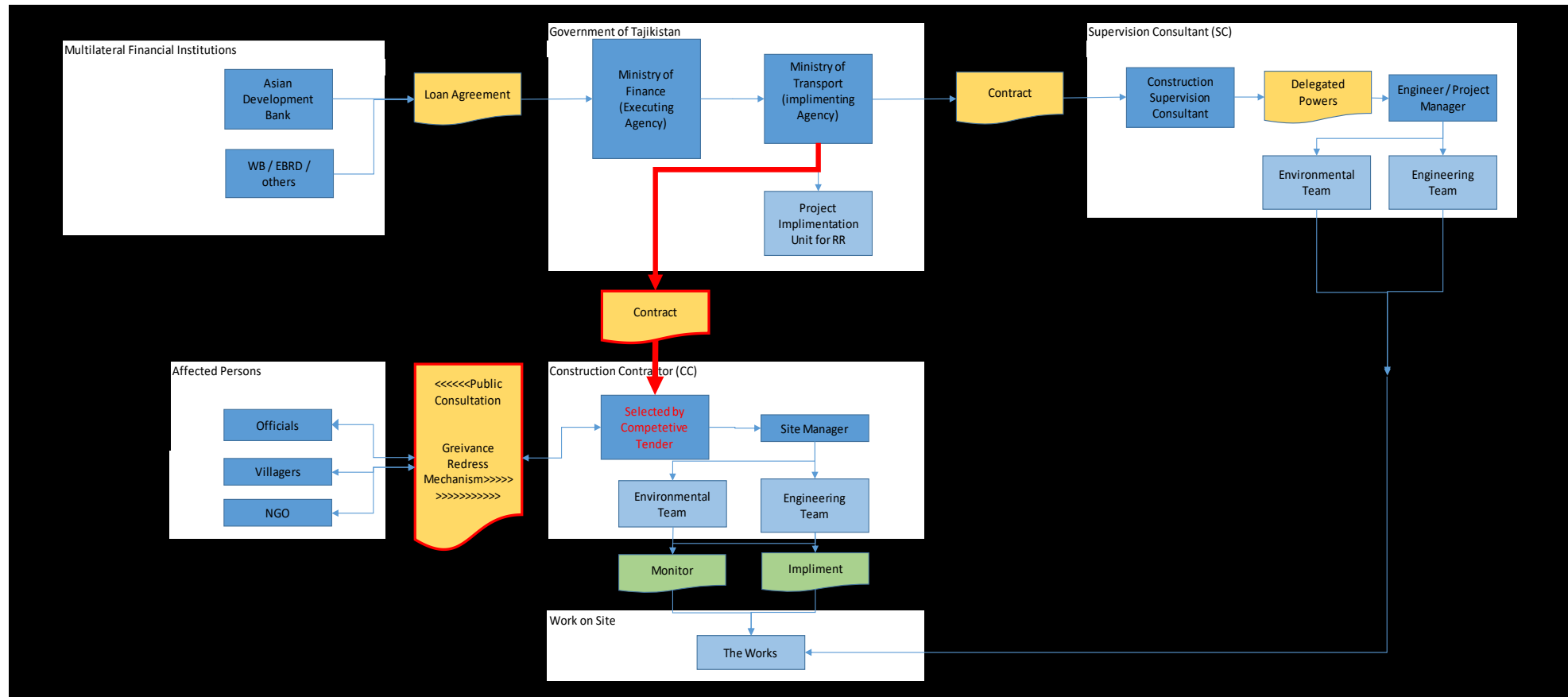
- Water - Construction of road embankments requires a substantial amount of water for compaction purposes, particularly in the dry season when the earth is dry, estimated at 10,000 litres every 1-2 hrs, plus 20,000 litres over a day for dust control over the active work areas. Similarly amounts would be required during pavement construction. Tunnelling would require about 6-8,000 l /day. Concrete work, (Bridges/drainage need water but probably no more than 1 -2,000 l per day depending on how many different sites they are working. This water will be taken from streams crossing the road or the Reservoir/Sukhrob River and not from the springs used by the villages.
- Construction materials – To minimise degradation of landscapes and soil erosion the Contractor(s) will reuse spoil or, if needed, use existing quarries or new quarries near the alignment for required additional materials, where this is possible. This will limit the need for new quarries. However, a limited number of new borrow pits may be required.
- Human resources – the project workforce will be both local and from other areas of Tajikistan overseas. Local employment and procurement will be engaged where available and suitable, and a Local Employment and Procurement Plan will be implemented to reinforce this.
- Fuel and energy

3.8 Proposed Project Delivery Mechanism

121. The project is currently in the baseline data collection phase to confirm: need; technical feasibility; acceptable cost; acceptable level of environmental and social impact, etc. ADB on behalf of the Ministry of Transport has commissioned a specialist team to carry out the “due diligence” aspect of the project. This EIA document is an output from the due diligence process. The EIA document will be used to assist the ADB and the EBRD in approving the loan / grant and the EMP component will be adopted in the final design and construction contract to identify environmental requirements and practices that will be included in the works. In this due diligence phase the parties involved are: Asian Development Bank, EBRD, Ministry of Transport, ADB appointed due diligence specialists and other project stakeholders (Government agencies, affected communities, NGOs, etc.)

122. In the implementation phase Contractors will be added to the parties involved in the project. Figure 15 identifies the key players who will implement the project. The construction contracts will be signed between The Ministry of Transport and the successful contractors. ADB (and other agencies) will provide funds to the Government to pay for the works through MoT and a Construction Supervision Consultant will be appointed to act as the Engineer for the contracts on behalf of the MoT under certain delegated powers.

Figure 15: Parties engaged in Project Delivery at the Construction Phase



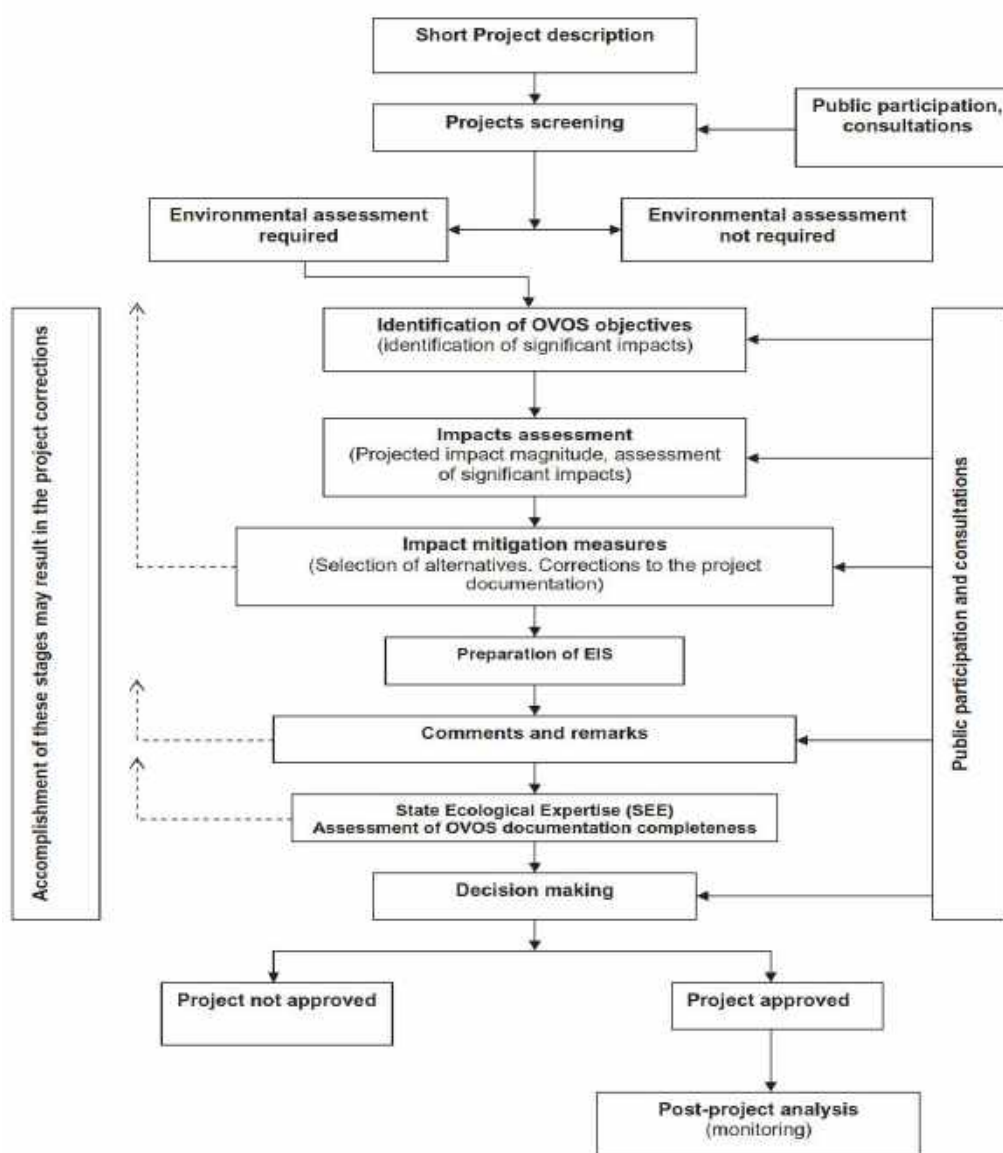
3.9 Schedule and Timeframe

123. The current (tentative) programme is:

- design finalised by end of January /early February 2019;
- preparation of bidding documents mid January 2019 onwards;
- EIA ready for disclosure on the ADB and EBRD websites by mid June 2019;
- 120 day (four month) disclosure on ADB and EBRD websites;
- 60 day disclosure of the local EIA (OVOS) under Tajik State Committee for Environmental Protection (SCEP) rules. Disclosure will be via the MoT website and distribution of literature summarising the project, public consultations and in local newspapers (where these exist). The locations for disclosure and conducting public consultations to cover representative stakeholders along all parts of the proposed roadway are the following:
 - Jamoat Obi-Garm;
 - Jamoat Khakimi;
 - Jamoat Mudjikharf; and
 - Nurobod city.
- Project considered by ADB & EBRD Boards for funding approval November 2019;
- Contractor ready to mobilise in spring (end of winter construction shutdown) 2020.

124. The process for disclosure and approval of the OVOS is shown in Figure 16.

Figure 16: Disclosure and Approval Process for OVOS



Source: United Nations Economic Commission for Europe Environmental Performance Reviews – Tajikistan, Second Review (2012)

125. An impact assessment of the proposed village access roads will be conducted as a supplement to this EIA, and disclosed after this EIA. This assessment will include consultation with stakeholders and identification and assessment of potential receptors (biodiversity, cultural heritage, etc.).
126. An impact assessment of the proposed permanent long bridge will also be conducted as an addendum to this EIA, but will be disclosed separately outside the timescales described above, once the detailed design has been prepared.

3.10 Project Costs

127. The Technical Assistance Report prepared by ADB in June 2018, mentions the following:
128. The project is expected to cost about \$400 million. The government of Tajikistan has approached the Asian Development Bank (ADB), the European Bank for Reconstruction and Development, and the Asian Infrastructure

Investment Bank (AIIB) to help finance the project. The government will provide counterpart funding of about \$70 million equivalent to cover taxes and duties, land acquisition and resettlement costs, incremental administrative expenses, financing charges, and other miscellaneous costs”.

3.11 Project Categorisation by ADB

129. ADB uses a classification system to reflect the significance of a project’s potential environmental impacts. A project’s category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project’s area of influence³⁰.
130. Category A projects. A project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.
131. Category B projects. A project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required.
132. Category A projects require a 120-day disclosure period before Board consideration.
133. ADB has prepared a set of Rapid Environmental Assessment (REA) Checklists to assist in the categorization of projects. In reaching a decision for this project the REA for roads and highways was used.
134. The project will be constructed on an alignment developed during the Soviet era. Several of the planned bridges and the three planned tunnels were not completed, and the alignment has been abandoned with cut slopes and embankments eroded over time. While bulk earthworks will be required to remediate embankments and cut back slopes to stable angles these works will not be as extensive as full reconstruction. Subsequent works are the forming of the engineered layers and the asphalt running surface. These works will require engineered stone from a crushing and grading operation and operation of an asphalt plant.
135. The alignment passes close to 17 villages (Table 11). Of these it bisects three, passes over three on existing bridge structures, and the remainder are generally bypassed on the uphill side that offers some shielding from construction and operation noise sources.
136. The hot summers and the clay like material on the alignment and access roads result in severe dust pollution from vehicle movements on dry, dusty surfaces. Dust management will be required.
137. The alignment passes through a highly modified landscape of grazing land. There was no permanent native woodland identified during field trips. River

³⁰ Extracted from the ADB Safeguard Policy Statement (ADB 19 para 50)

valley bases, where villages are sited have tree planting to provide shelter belts, orchard crops and wood for fuel.

138. Based on field observations and the engineering design, the Project Team prepared the REA. ADB concluded that the project should be defined as Category A for Environmental Safeguards and this document has been prepared on that basis.

3.12 Project Categorisation by the EBRD

139. Under the EBRD ESP projects are categorised as A, B, C or FI to determine the nature and level of environmental and social investigations, information disclosure and stakeholder engagement required. This will be commensurate with the nature, location, sensitivity and scale of the project, and the significance of its potential adverse future environmental and social impacts.
140. A project is categorised A when it could result in potentially significant adverse future environmental and/or social impacts which, at the time of categorisation, cannot readily be identified or assessed, and which, therefore, require a formalised and participatory Environmental and Social Impact Assessment process.
141. Contained within the example list of Category A projects that relate to this project are:
6. Construction of motorways, express roads and lines for long-distance railway traffic; airports with a basic runway length of 2,100 metres or more; new roads of four or more lanes, or realignment and/or widening of existing roads to provide four or more lanes, where such new roads, or realigned and/or widened sections of road would be 10 km or more in a continuous length.
142. The project has four lanes in some sections and exceeds the 10 km length threshold, so would be classified as Category A by EBRD.

4 Analysis of Alternatives

4.1 Definitions and overview

143. One of the reporting requirements of an EIA is to investigate alternatives to the Project. In relation to a proposed activity, “alternatives” means different ways of meeting the general purposes and requirements of the proposed activity. Normally this section will include an assessment of alternative corridors, alignments, transport modes and technologies, as well as the ‘no project’ alternative.
144. In this case the inundation of the existing M-41 road corridor will remove all access to the established towns of Nurobod and Obi Garm for the existing 72,767 population³¹ so the ‘no project scenario’ would have major social consequences, as detailed in Section 4.2.
145. Alternative corridors have not been considered, because they would require long diversion through adjacent valleys, and would not reinstate access to the towns of Nurobod and Obi Garm, and other villages along the alignment, when the existing M-41 is inundated.
146. The proposed alignment was established in the Soviet era. Therefore, the corridor is effectively fixed. Partial construction of the identified alignment, including bulk earthworks for cuttings and embankments, has already been undertaken and the route has generally been protected from development. It is therefore reasonable to assume that the environmental and social impact of any alternative alignment is likely to be greater than the established alignment, so there is limited value in assessing alternative alignments. The analysis therefore focuses on the established alignment and options for modification to this alignment.

4.2 No Project Scenario

147. A “no project” scenario would leave villages on the alignment with only the completed soviet era sections including cuttings and embankments as access road link. Villages at the west end of the alignment (before the Kandak tunnel) would have access to Obigarm along the substandard section of the soviet era alignment and on existing village access roads. Villages to the east of the Kandak tunnel would have no formal access, other than pedestrian tracks across mountain passes. None of the three tunnel sections are complete, so there would be no through access to villages in the central section of the road. In addition, villages to the east of the third tunnel would have no access to Nurobod since the existing bridge crossing will be flooded by the Rogan Dam reservoir.
148. The no project scenario would deprive a 2018 population³² of 72,767 of access to medical facilities, emergency services, markets and transport opportunities.

4.3 Alternative Alignments

149. Given the increasingly complex topography (mountainous) and geological conditions to the north, and the severance effect of the Rogun dam

³¹ The population is derived from project district populations based on Districts’ and Jamoats’ statistics. See Table 3.1 (Population in Project Districts) LARP (Dec 2018)

³² Source - Project LARP (Dec 2018)

impoundment and reservoir to the south, there are no other feasible alternative alignments.

4.4 Modifications to the Alignment

150. A number of micro-realignments of the proposed route have been made since the original design, including:

- Realignment to avoid a cemetery on the original routing (km 70 +500);
- Modifications to cut slopes;
- Road curvature;
- Modification / reconstruction of bridges;
- Addition of tunnel no 3 (Package 2) to eliminate a stretch of winding road, improving journey times and road safety;

151. The design consultants have reviewed the works carried out during the Soviet era and concluded that modification was needed to bring the road design (primarily road safety and engineering design requirements) up to current standards. This required modifications to cut slopes (flatter slopes for slope stability), road curvature (to maintain safe design speeds on the alignment) and the modification / reconstruction of bridges that had suffered from lack of maintenance creating structural safety (durability) issues. The two soviet era tunnel sections (Kandak and Karagach) and the new tunnel section (Tagikamar) are all new designs, as there was no significant construction during the Soviet era.

152. The design consultants identified a section (km 29.5 to km 39.25) where the road climbed to a high pass via a series of tight curves and concluded that from a road safety, cost and design perspective a 2.6 km tunnel section was more appropriate, reducing the alignment distance by 6.5 km. This is the Tagikamar tunnel, tunnel no 3, (Package 2). The location and approach are illustrated in Figure 17.

Figure 17: New Third Tunnel (Tagikamar) – showing earlier “high pass” no tunnel option



4.5 Alternative Road Surfacing

153. Asphalt and concrete pavement types have been considered. Priority was given to asphalt. This type of pavement has been chosen because there is:

- less noise during operation, compared to concrete (less noise nuisance for existing residents and wildlife);
- less vibration compared to concrete (many buildings along observed to be of mudbrick construction);
- better visibility of road markings on black asphalt (edge and lane markings - Road safety);
- better in winter snow/ice melt;
- recyclability of material.

4.6 Alternative Tunnelling Techniques

154. There are two techniques that could be considered for the three tunnel sections:

- Drill and Blast; and
- Tunnel Boring Machine.

155. However, due to the relatively short tunnel lengths drill and blast has been selected for the tunnel design. The three tunnel sites are remote from sensitive receivers (residential receptors in the villages, ecological receptors) so noise and vibration impacts are unlikely to be an issue. The assessment will proceed on the basis of drill and blast.

4.7 Road Safety Improvements

156. A number of design amendments have been made to improve road safety on the alignment, as a response to community consultations and a road safety audit conducted in November 2018³³, as follows:

- An advisory 40 km/h speed limit in villages will be applied. This may be made mandatory subject to approval by the MoT and the Tajik Traffic Police
- Crossings will have a raised “island” across the parking lanes in villages, which means that pedestrians will need to cross a maximum of 2 lanes at any location. The provision of parking lanes may also provide an economic opportunity, as they provide a location for drivers to stop and rest, and a location where local people can sell produce;
- Crossing points will be moved away from the apex of intersections away from the path of turning traffic – to reduce the potential for accidents;
- Warning signs will be installed at all pedestrian crossings;
- Various improvements to road markings and signage; and
- Modifications to proposed tunnel control offices to improve operator safety during access / exit.

4.8 Other Amendments

157. Asbestos containing materials were originally specified in the designs for the tunnels. To comply with EBRD and ADB standards, this material has been removed from the specifications, and will not be used for this Project.

³³ Detailed design stage road safety audit report for the proposed Obigarm-Nurabod Highway, northern Tajikistan, Road Safety International

158. Provision will be made for installation of 6 inch pipes at intervals below the carriageway in residential areas to allow passage of water pipes and other village services. The location of the pipes will be finalised in discussion with the local communities. The 6 inch pipes would provide a conduit for water pipes, and ensure they can be maintained and replaced without excavating the carriageway. This design solution would avoid the need to excavate the carriageway to maintain the water pipes.

4.9 Cumulative Impact Assessment

159. There are no other projects in the area that will impact on or be impacted on the Obigarm Nurobod Road Project. The Rogun Dam project is complete and the dam is now being impounded. The first turbine was commissioned in November 2018³⁴ and the second is scheduled for commissioning in 2019. Each turbine has an installed capacity of 6MW and there is provision for 6 turbines to be installed. It should also be noted that the Roghun dam sourced much of its rockfill requirements from inside the impoundment area and the processing facilities were developed within the impoundment area. The M41 road was not a significant construction corridor. There are no other major projects planned or in progress within the influence area of the project.

³⁴ <https://www.salini-impregilo.com/en/press/news-events/tajikistan-president-starts-first-turbine-of-rogun-hydropower-plant-being-developed-with-the-participation-of-salini-impregilo.html>

The Italian company Salini Impregilo have been responsible for the final stages of the dam construction and the commissioning of the turbines.

5 Description of the Existing Environment

5.1 Introduction

160. This section describes the current environmental and social baseline of the area within which the project is located. It also identifies the future baseline, which is the anticipated trends in the baseline that would occur without the scheme.

5.2 Topography and Landscape

161. The area of the road belongs to the Hissar-Alai region. The relief of this region is typically mountainous, with access to the sub-Alpine and Alpine zones in the upper part of the ridge, with steep peaks and small glaciers. Almost every gorge has rough streams and rivers. On the steep slopes there are rocks and numerous stone scree deposits.

162. There are ridges of latitudinal and sublatitudinal strike, including the ridges of: Zeravshan, Turkestan, Hissar and Karategin. The road starts at the Western spurs of the Karategin ridge and stretches along its southern slope almost to its middle. The road passes through the valley of the Obigarm river from the village Obigarm and then runs parallel to the Vakhsh river, almost to its source.

5.3 Soils, Geology and Hydrogeology

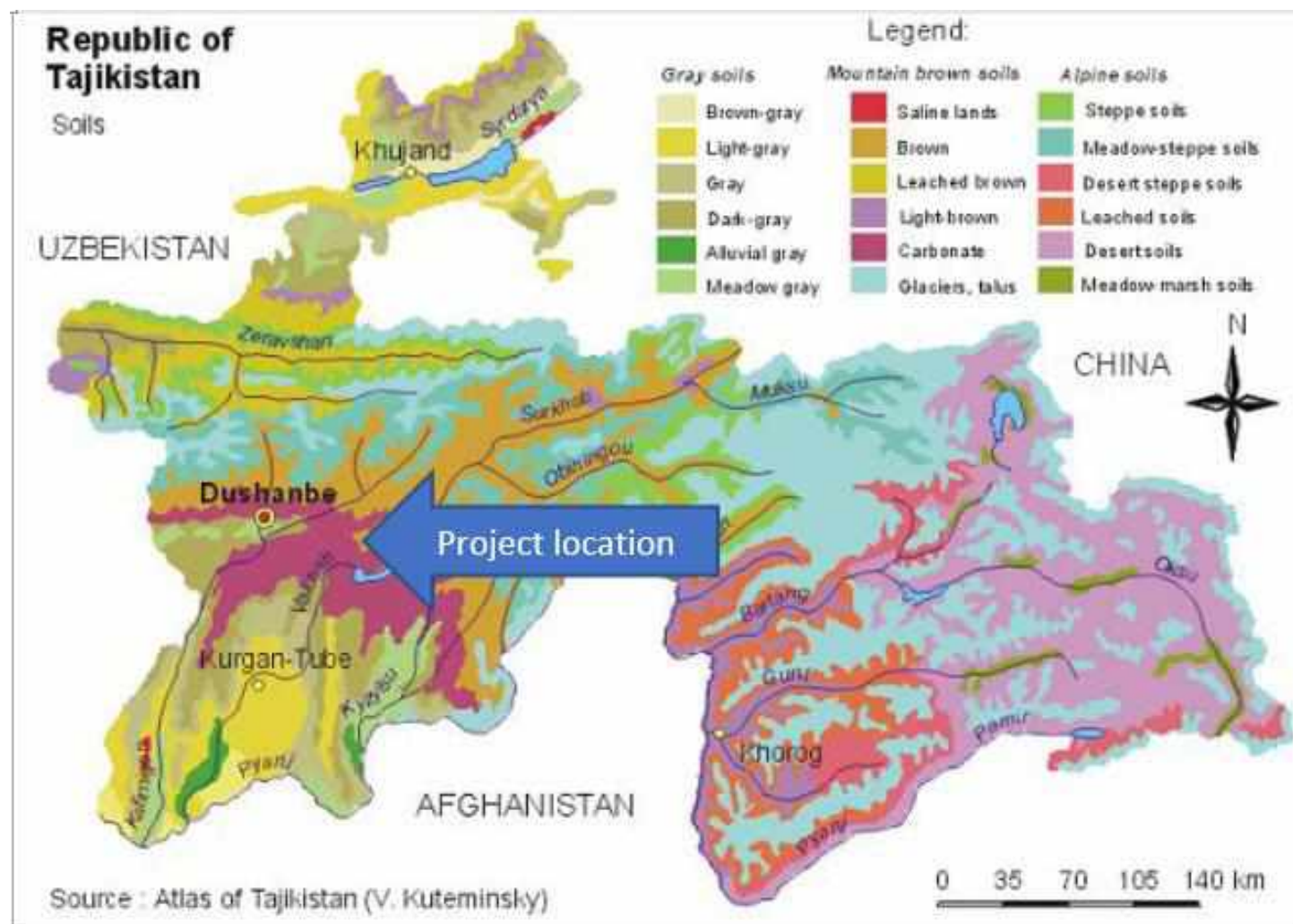
5.3.1 Geology and Soils

163. The Republic of Tajikistan has a complex relief and geological structure. The rocks covering the country were formed from the Archean-Proterozoic to the Quaternary period and are mainly represented by rocks formed through volcanic activity and rocks of sedimentary origin. The geological structure of the country is divided into Karamazar (Northern Tajikistan), Central Tajikistan (Hissar – Alai), Pamir (with Darvaz), Tajik depression and Fergana depression. The project is located in the Hissar-Alai region.

164. The Hissar-Alai region is rich in minerals, including: antimony, mercury, tungsten, tin, gold, arsenic, etc. The area is also rich in mineral waters and hot springs.

165. Most of the country is covered by mountainous terrain, with only 7% of the land area in valleys, so the soil cover of the territory is varied and unevenly distributed. The country has varied climatic conditions, resulting in different types of soils (up to 15 types). The parts of the project alignment that are located at lower altitude have soils that are generally brown, and well-moistened. In the upper levels (highlands) they become Alpine meadow-steppe and steppe light brown. A map of soil types in Tajikistan is shown in Figure 18.

Figure 18: Soil Types in Tajikistan (including the project alignment)



166. Engineering geological surveys were conducted by the designers Avtostrada in 2016-18³⁵, building on surveys conducted during the geological studies conducted during the Soviet era. The studies were conducted on two 42.5 km sections of the alignment – from Chainage 0 to Chainage 424+80, and from Chainage 424+80 to Chainage 759+14. These identified that the nature and thicknesses of soils across the survey area is highly heterogeneous, and identified the following engineering geology elements (EGE), over the area of investigation (Table 15).

Table 15: Lithologies Identified in the Project Area

Number of EGE	Description of soil
1	Sand with the inclusion of crushed stone more than 10%.
2	Crushed stone with the inclusion of boulders up to 10%
3	Loam of a solid consistency, light, silty, with inclusion of crushed stone more than 10%
4	Loam of light, silty, solid consistency with inclusion of gravel up to 10%
5	Weathered granite of very low-strength
6	Strongly weathered granite, low strength
7	Medium weathered granite, medium strength
8	Medium strength slates
9	Conglomerates with limestone cement
10	Silty boulder with inclusion of oversized rocks up to 5%, aggregate sand up to 30%
11	Silty boulder. Basically, lies in river beds
12*	Crushed stone with the inclusion of blocks up to 30%, aggregate loam more than 40%
13	Crushed stone with the inclusion of blocks up to 30%, aggregate loam more than 40%
14	Light loam, silty from high-plastic to very soft consistency with inclusion of pebble and gravel up to 30%
15	Granite medium-weathered, stiff
16	Granite slightly weathered, stiff

-
- ³⁵ Vahdat – Rasht – Jirgatal – Kyrgyzstan Border Road (From km 72 to km 158), Stage II Road Section From Chainage 424+80 To Chainage 759+14: Technical Report On The Results Of Engineering-Geological Surveys For The Development Of Working Design: Ref 16-16-Egs, Dushanbe, 2018; and
 - Vahdat – Rasht – Jirgatal – Kyrgyzstan Border Road (From km 72 to km 158), Stage II Road Section From Chainage 0 to Chainage 424+80: Technical Report On The Results Of Engineering-Geological Surveys For The Development Of Working Design: Ref 16-16-Egs, Dushanbe, 2018

17	Crushed stone with the inclusion of blocks up to 30%, aggregate sand up to 30%
18	Gruss in bedrock
19*	Asphalt concrete soil (remains of asphalt concrete pavement)
20	Soil-vegetative layer with inclusion of crushed stone and boulder, roots of vegetation more than 10%
21	Silty boulder, aggregate loam more than 40%
22	Crushed stone with the inclusion of boulders up to 30%, aggregate sand more than 40%
23	167. Crushed stone with the inclusion of boulders up to 30%, aggregate sand more than 40%. The plasticity and soil moisture are made of aggregate
24	Slates, stiff
25	Slates, sandy, stiff
26**	Gruss, filler sand
27**	Loam, light, dusty fluid consistency with inclusion of crushed stone up to 30%
28**	Limestone, medium strength
29**	Hard marly limestone
30**	Hard dolomitic limestone

* Only referenced in survey report for Chainage 0 to Chainage 424+80

** Only referenced in survey report for Chainage 424+80 to Chainage 759+14

Source: Avtostrada Engineering Geological Survey (Chainage 424+80 to Chainage 759+14) 2018 and Avtostrada Engineering Geological Survey (Chainage 0 to Chainage 424+80) 2018

168. The Avtostrada Engineering Geological Survey (Chainage 0 to Chainage 424+80) indicates the following lithologies are present

- Unconsolidated Quaternary deposits comprising heterogeneous channel deposits and low alluvial terraces, with a cover of loamy material with detrital material of younger generations of proluvial and mudflow sediments in some locations
- Complex of continental deposits, represented by Neogene deposits of two main types.
 - Conglomerates of grey colour, fine-grained, dense, with sandy-clay cement. They contain interbeds of grey and reddish-brown, loose sandstones.
 - More widely spread interstratification of siltstones, clays, sandstones, conglomerates of grey and reddish-brown colour. Conglomerates are small and medium-sized, dense, strong, on sandy-calcareous cement, not fissured, slightly weathered.

- Complex of Proterozoic metamorphic rocks formation. Deposits are represented by crystalline schists. The colour of the rocks is grey and dark grey. The structure is dense, and the texture is layered, banded, and massive. The thickness of the deposits is 1,800-2,400 m.
- Complex of intrusive formations, represented by various granites, diorites, gabbros, quartz diorites.

169. The Geotechnical Inception Report³⁶ indicates that the road foundation is laid mostly on geological unit 15, 16, 17 and 18 which are classified as medium to hard granite, gruss on bed rock and crushed stone.

170. Other detailed geotechnical studies have been conducted for specific elements of the road construction (bridges, tunnels, etc.) and these are summarised below.

Tajikamar Tunnel

171. A geological engineering study for the Tajikamar Tunnel³⁷ in the centre of the alignment indicates the following geology in the vicinity of the tunnel

- 1-10 m of Quaternary eluvial deposits comprising loams and sandy loams from hard to refractory consistency. The composition of the source rock granites and granodiorites are strongly-medium weathered. The surface up to 20 cm contains plant roots.
- Late Carboniferous intrusive igneous rock, comprising granite and granodiorite, grey-white / grey-brown, with a medium-fine grained massive texture. The main mineral composition consists of quartz, orthoclase, amphibole and mica. There are four sub-layers of weathering - fully weathered, strongly weathered, medium weathered and a zone of intensive fracturing.

Bridge No 10

172. A geological engineering study for Bridge 10, across the Dashtiguron River³⁸ indicates that the geology in the location comprises Carboniferous granites overlain by soils and Quaternary drift deposits.

Bridge Nos 9, 11, 12 & 13

173. A geological engineering study for Bridges 9 (Mirzoshafiron River), 11 (Tegirmi River 1), 12 (Tegirmi River 2) and 13 (Kalod River)³⁹ indicates that the geology in these locations comprises Carboniferous granites overlain by soils and Quaternary drift deposits.

³⁶ • Preparing the Central Asia Regional Economic Cooperation Corridors 2, 3, and 5 (Obigarm-Nurobod) Road Project Consultants' Services; Inception Report – Geotechnical Consultancy Services, August 2018

³⁷ Avtostrada Report Ref 16-16-AS.T03-CS-EN, 2017

³⁸ Vahdat – Rasht – Jirgatal – Kyrgyzstan Border Road (From km 72 to km 158), Bridge Across Dashtiguron River: Technical Report On The Results Of Engineering-Geological Surveys For The Development Of Working Design: Ref 16-16-EGR, Dushanbe, 2018

³⁹ Vahdat – Rasht – Jirgatal – Kyrgyzstan Border Road (From km 72 to km 158), Bridges Nos 9, 11, 12, 13: Technical Report On The Results Of Engineering-Geological Surveys For The Development Of Working Design: Ref 16-16-EG-T, Dushanbe, 2018

5.3.2 Hydrogeology

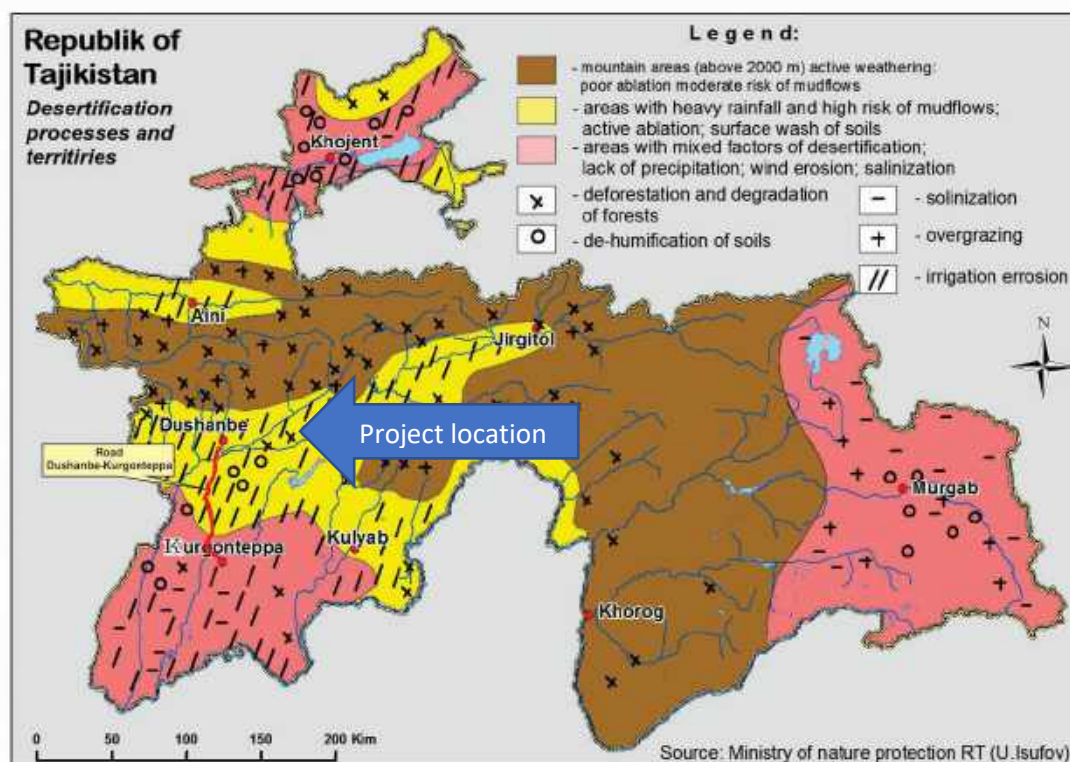
174. The Avtostrada Engineering Geological Surveys (Chainage 0 to Chainage 424+80 and Chainage 424+80 to Chainage 759+14) indicate that the rock formations of the region are characterized by steep incidence angles and large fractures, which means that resisted water-bearing strata along the area are absent. Underground waters, by the nature of their spread, are trenches, fissure-pore and pore. They are confined mainly to alluvial deposits, and on the surface occur as springs. The formation and accumulation of groundwater in this area is associated with atmospheric precipitation, falling in the form of rain and snow. The high degree of fracturing of intrusive rocks and the complex tectonic structure of the area in general, contributes to the intensive absorption of atmospheric precipitation and snow melt, which are the main source of recharge of groundwater resources.
175. During these surveys, groundwater was identified in 13 pits dug along the Project at depths of between 1.0 and 8.0 m. Groundwater was not encountered below a depth of 3.0 m in the remaining pits. Groundwater was also recorded by the Avtostrada Engineering Geological Survey for Bridges 9, 11, 12 and 13, with recorded depths of at 10.0 m (Bridge 9 – based on Soviet era survey), and between 2.0 and 4.7 m at Bridges 11 and 12.
176. Brief descriptions of localised soil outcrops at river crossings along the alignment are also provided in Section 5.10.1

5.3.3 Desertification

177. Soil erosion is a key problem for Tajikistan. Erosion is a widespread natural phenomenon due to the country's topography and climate, but is exacerbated by weak management practices such as: grazing on steep mountain slopes, over-felling of forests and shrubs, forest degradation, overgrazing and inadequate irrigation. Soil erosion in the Project area has had a notable impact on the parts of the road that were constructed in the soviet era.
178. The two main factors causing soil degradation in the project area are wind and water flowing over slopes, creating gullies that accelerate the erosion process. Anthropogenic factors have accelerated this erosion through intensive agricultural development on road slopes and unsustainable crop cultivation practices.
179. While natural factors contribute to soil erosion, unsustainable human behaviour has accelerated the process to an unacceptable degree: it is estimated that 97% of agricultural land in Tajikistan has some level of erosion. Land degradation caused by erosion from overgrazing affects about 3 million hectares of land or 85% of pastures (Asian Development Bank, 2004). In addition, excessive use of pesticides and fertilizers has led to pollution of the soil and watercourses.
180. Since the 1930s, intensive development of foothill valleys and flood zones has occurred to increase the area of arable land. Up to 100 thousand hectares of flood zones, pistachio trees and partially deciduous forests were destroyed in the process of land development. During the economic and energy crises in the 1990s, juniper forests were cut down. Deforestation and reduction of pastures of animals, forests had a negative impact on the quality and diversity of forests, and the natural renewal of forests has almost stopped.

181. In the zone of influence of the project, in the Komsomolabad, Mujiharf, Khakimi, Safedchashma jamoats, intense erosion processes (water erosion, gully) are strongly observed. Figure 19 shows the extent of desertification in Tajikistan and the location of the project in context. It shows it is located in an area with heavy rainfall and high risk of mudflows, which is also subject to irrigation erosion and degradation of forests. In the Project area, erosion effects are managed at a local level in all jamoats.

Figure 19: The Process of Desertification in Tajikistan



Source: Tajikgeodesy

182. The widespread degradation of land resources in Tajikistan will increase the susceptibility of land to the effects of climate change, as set out in Section 5.5 Climate Change.

5.3.4 Contamination

183. No investigations for soil and/or groundwater contamination are known to have been conducted in the vicinity of the alignment. However, given the generally remote and undeveloped location of the area around the alignment, the potential for existing contamination is considered to be low. There is potential for residual contamination (e.g. from fuels and hydrocarbons) associated with the original works for construction of the alignment in the 1980s. However, if present, this would be anticipated to be localized and is likely to have substantially degraded since that time.

5.4 Climate

5.4.1 Climate – Tajikistan⁴⁰

184. The climate of Tajikistan is continental, influenced by its position in Central Asia at the border between the subtropical and temperate climatic zones. The main features of Tajikistan's climate are: high solar radiation, low cloudiness, long sunshine hours, rapid changes of daily and seasonal air temperatures, uneven distribution of precipitation during a year, and high dust content in the air.
185. In the mountain regions of Tajikistan there are glaciers covering a total area of 8,400 km² (which is ca 6% of the country's area). An ongoing decrease in the country's glacial area and volume has been observed. The road alignment is generally between 1300 m and 1600 m asl.
186. In the cold part of a year there is a polar front over Tajikistan. The weather is affected by dry and cold air masses moving from the Siberian anticyclone and meeting the damp warm air from the Atlantic Ocean in the form of cyclones.
187. Annual mean temperature in the south is +17°C, in the Pamirs it reaches -6°C.
188. Maximum air temperature can reach +47°C on the south; the lowest temperature can reach - 63°C in the Eastern Pamirs.
189. Precipitation is distributed unevenly both temporally and spatially. Annual rainfall is 400-1,200 mm in the west of Tajikistan. The highest totals are measured at the Fedchenko Glacier (more than 2,000 mm per year).
190. Areas up to 1,000 m asl are characterized by a warm summer with an average temperature of 30°C, and in the months of June–September there is little precipitation. For the mountain ridges of Central Tajikistan and the Western Pamirs, a mild climate is typical: the summer is cooler, winter is cold, and there is high precipitation during the winter season.
191. Mean annual wind speed can vary between 0.8 to 6.0 m/sec. Wind direction and speed greatly depends on the atmospheric circulation and landscape. The strongest winds blow in highland areas (e.g. Fedchenko Glacier in the Central Pamirs) and in the areas where landscape results in the convergence of air flows (Khujand, Fayzabad). Mean annual wind speed in these areas can reach 5-6 m/sec.
192. Additionally, frontal sandstorms that accompany cold-wave intrusions, rush upwards along the valleys of Kafirnigan and Vakhsh. At the same time a strong wind (18-20 m/sec) along with sandstorm blow for several hours. The biggest number of days with sandstorms is observed in the south of the country and reaches 14 days a year.

5.4.2 Climate – Project Area

193. The Obigarm-Nurabad road project corridor, 72 km to 158 km is served by two meteorological stations⁴¹:
 - Weather station Bostanabad located on the eastern part of Faizabad district;

⁴⁰ Information taken from Technical Assessment Report (Working Draft 1) Assessment of climate change risks to Vahdat – Kyrgyz Border Rehabilitation Project, Mott MacDonald, 31 May 2019

⁴¹ Location information taken from https://www.jma.go.jp/jma/jma-eng/satellite/ra2wigosproject/documents/5th_meeting_program_presentation/CountryReport/Tajikistan.pdf

- Weather station Nurabad, located in Nurabad district.

5.4.2.1 Bostanabad Weather Station

194. The station is located between the Karategin Range to the north-west and the Vakhsh Range to the south-east in the Faizabad district. The height of the station is 1,964 m above sea level.
195. The territory of Bostanabad located in an area of low humidity with warm summers and moderately mild winters.
196. The average annual temperature is 7.6 °C.
197. The frost-free period lasts on average 252 days per year.
198. The average temperature of the coldest month (January) is -4.8°C. The average minimum air temperature is -8.50°C, but with the invasion of large cold air masses it can be reduced to -25 to -28°C. At the same time during the day the air in the winter months on some days can warm up to 9-15°C.
199. The average temperature of the warmest month (July) is 20°C. In the hottest months, in the daytime the air warms up to 25-30°C, and the absolute maximum is 33°C. At the same time, if the average minimum temperature in the summer months is 12-15°C, and in the coldest years on some days it can fall at night to 0-5°C.
200. The average annual rainfall is 679 mm. The Bostanabad characteristic annual pattern of precipitation is a maximum in March-April and almost complete absence in August-September. Its main number 373 mm during the spring period, in the winter months falls 182 mm, 79 mm in autumn, and in summer 45 mm.
201. The average annual relative humidity is 53% and the average monthly humidity ranges from 33-75%
202. Snow cover appears in early October, but constant snow cover is from early November. Average maximum snow depth is 50-70 cm, sometimes reaching up to 100 cm,
203. In the area of Bostanabad the predominant wind direction is north-west (57% of the total number of cases). The average monthly wind speed ranges from 4-4.2 m/sec in the warm season to 5.2-5.8 m / sec in the cold season. The maximum wind speed recorded annually is 18 m/sec.
204. There are ice-frost phenomena: ice, frost, sleet, with up to 30 days per year where icing of all kinds occurs.

5.4.2.2 Nurabad Weather Station

205. Nurabad weather station is located in the eastern part of the Kuhistan mountain system. The height of the station is 1,258 m above sea level. The station serves the entire territory of Nurabad district. The location of Nurabad weather station is shown on Figure 20

Figure 20: Nurabad Weather Station



Source: Tajik Meteorological Service

206. The station is located in the spurs of the south-eastern slopes of the Karategin Range, in the valley of the Vakhsh river. The terrain is mountainous. The height of the mountains exceed 2,000 m. The width of the valley near the station is 3-4 km and quite heavily terraced. The Vakhsh river flows 2 km to the south.

207. The climate is dry, with warm summers and moderately mild winters.

208. Weather data for Nurabad was provided by Agency for Hydrometeorology under the Committee on Environmental Protection (Tajik Meteorological Service). Temperature and precipitation data are presented in Table 16.

Table 16: Nurabad Weather Station Temperature and Precipitation Data

Month	1	2	3	4	5	6	7	8	9	10	11	12	Annual
Average air temp °C	-3	-1.7	4.6	12.2	16.1	21.1	24.4	24.6	20.0	13.0	6.8	0.9	11.6
Average precipitation, mm	90.1	113.2	165.2	133.8	112.6	30.9	17.5	5.9	8.5	58.4	57.7	90.4	884.2

Source: Tajik Meteorological Service

209. Snow cover appears in November and disappears in February / March. Average maximum snow depth is 22 cm, sometimes reaching up to 90 cm.

210. In the area of Nurabad, winds of the northern and north-eastern directions prevail. The probability of maximum wind speeds is presented in Table 17.

Table 17: Nurabad Weather Station Wind Speed Data

Wind speed (m/s) recurrence once in				
1 year	5 years	10 years	15 years	20 years
18	22	24	25	28

Source: Tajik Meteorological Service

5.5 Climate Change

211. Climate change has been identified as an increasing threat to the environment in Tajikistan. The greatest concern is the increase in air temperature, which would lead to serious consequences in relation to glacial and water resources.

212. The World Bank Climate Change Knowledge Portal provides the following climate trends for Tajikistan⁴²:

Temperature:

- The temperature of the above-ground air rises in most areas.
- Since 1940, the mean annual temperature has increased by 0.3-1.2°C, with an average of 0.1-0.2°C per decade.
- The minimum mean temperature has also increased by 0.5-2.0°C, with some exceptions in high mountainous areas, where it has dropped by 0.1°C. Smaller temperature increases have been noticed in higher altitudes and larger increases in lower altitudes.
- Urbanisation has caused the near surface area temperature of large cities to increase by 1.2-1.9°C.
- The number of days with temperatures equal to 40°C or over has increased in the flattest areas of Tajikistan.

Precipitation:

- The mean annual precipitation is projected to decrease by 5% (see Figure 23)⁴³.
- In December, January, February and March, April, May the precipitation is projected to decrease by 2% and 5% respectively by 2050.
- In June, July, August precipitation and September, October, November precipitation is projected to increase by 1% and 4%, respectively.
- Dry days are projected to increase by approximately 3 days by 2050.
- Winters are projected to be drier and summers wetter. This could result in both increased floods and droughts.

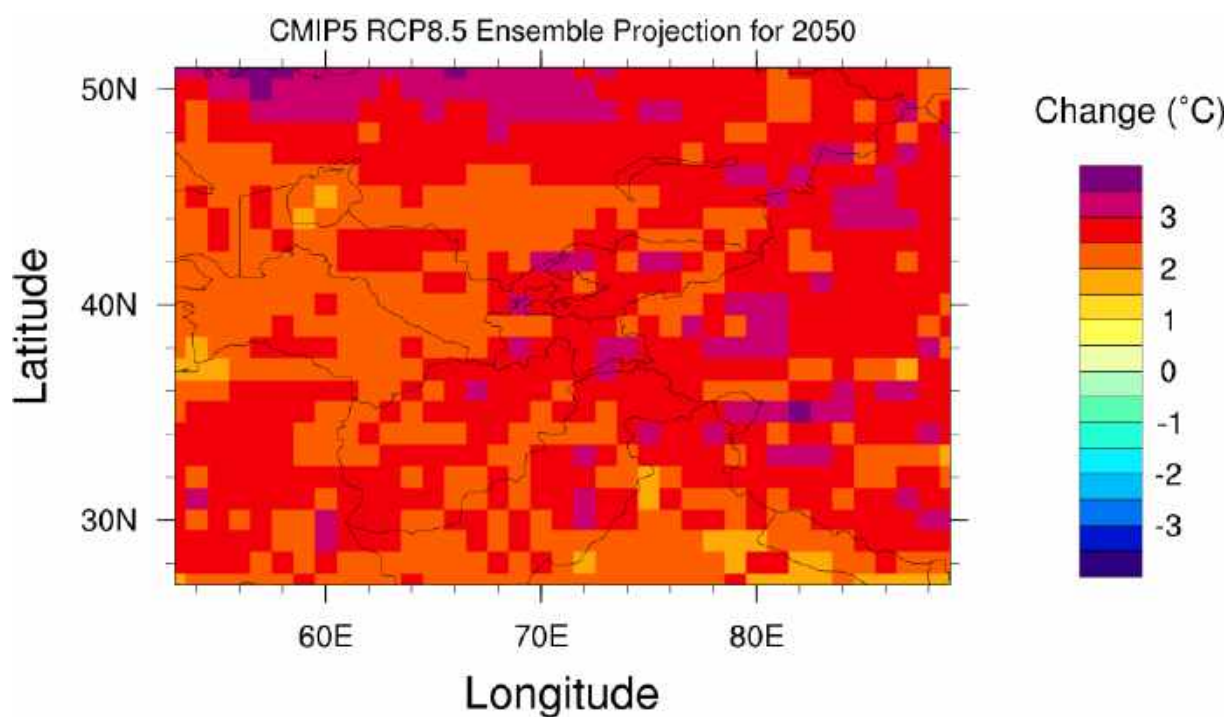
213. The following key climate projections are concluded:

- Mean annual temperature will rise by 2.7°C in 2050 (Representative Concentration Pathway (RCP) 8.5, High Emission) (see Figure 21 and Figure 22);
- Mean annual precipitation will rise by 18.1mm in 2050 (RCP 8.5, High Emission);
- Annual accumulated cooling degrees of temperature above 18°C will rise by 261.6°C in 2050. (RCP 8.5, High Emission); and
- Total annual hot days of temperature above 35°C will rise by 8.5 days in 2050 (RCP 8.5, High Emission).

⁴² <https://climateknowledgeportal.worldbank.org/country/tajikistan>

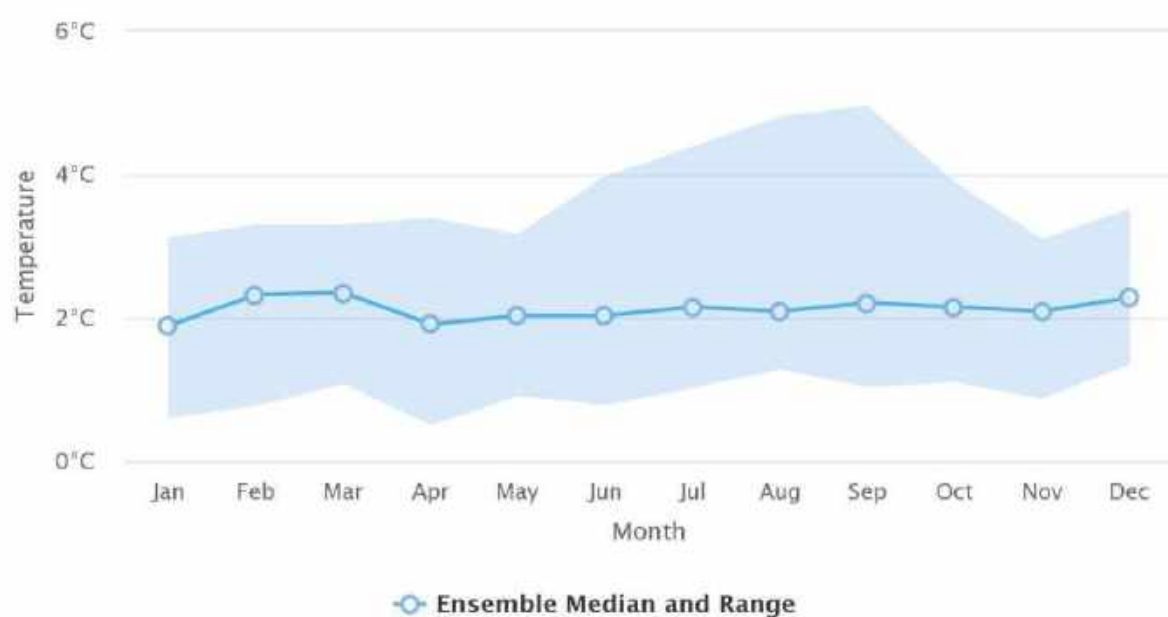
⁴³ The estimate is in contradiction with the information on the much higher 20% increase in precipitation contained in the document No 37.6 pursuant to Appendix A (*Document Register*) to this Report titled “The reply to Mr. Ed Vowles on the likely impact of climate change on road and bridge construction” given by the ADB climate change experts which predict an increase in precipitation of 20% which used a generalized assumption for the entire territory of Central Asia.

Figure 21: Map of the annual mean temperature change for 2050



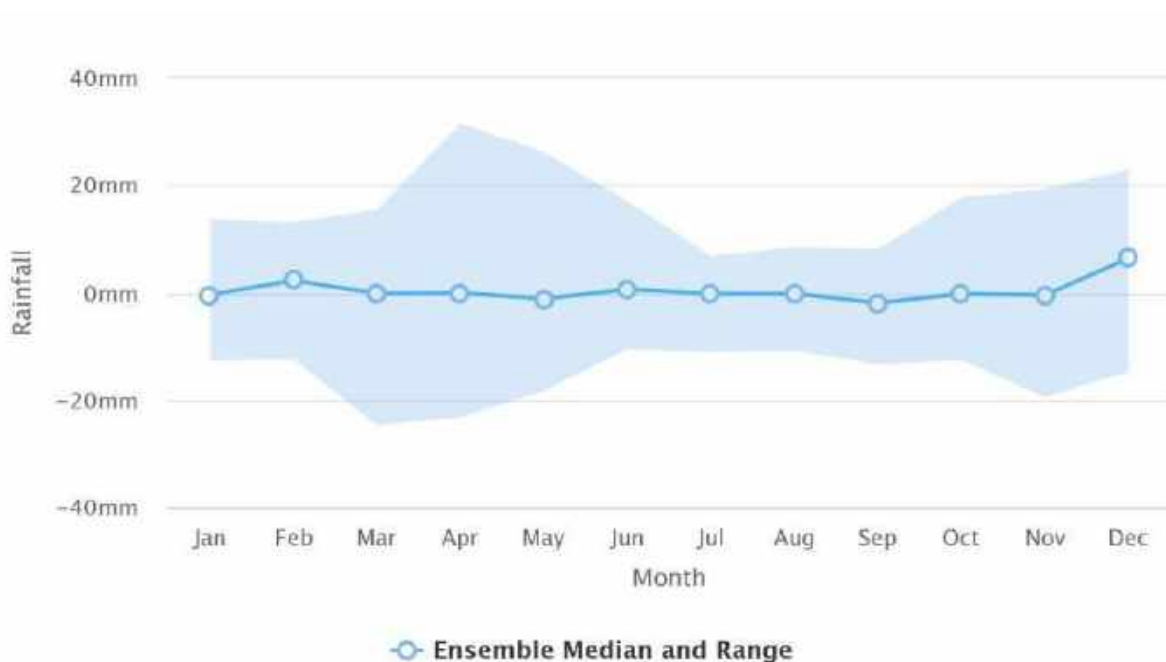
Source: Climate Change Knowledge Portal, <https://climateknowledgeportal.worldbank.org/country/tajikistan>

Figure 22: Projected change in monthly temperature for Tajikistan for 2040-2059



Source: Climate Change Knowledge Portal, <https://climateknowledgeportal.worldbank.org/country/tajikistan>

Figure 23: Projected change in monthly precipitation for Tajikistan for 2050



Source: Climate Change Knowledge Portal, <https://climateknowledgeportal.worldbank.org/country/tajikistan>

214. In addition to changing temperature and precipitation⁴⁴, it is anticipated that there will be more extreme intensities, such as extreme temperatures, isolated abnormal precipitation⁴⁵, and prolonged droughts. These factors are particularly relevant for transport infrastructure structures with a long lifetime, such as bridges and tunnels.

215. The key climatic hazards are anticipated to be:

- Temperature (extreme high temperature) / heat stress - Higher temperature fluctuations. The projected average temperature may also increase average moisture levels in the Project Area;
- Precipitation (intense) / avalanches, mudslides, landslides, rock falls, floods and mudflows: Higher and more intense precipitation (torrential rains) and higher flows in rivers which may result in a greater risk of flash floods, and associated mudflows. This will also cause more intense erosion and a higher risk of mudslides and landslides, both in terms of their occurrence and harmful effects;
- Glaciers and snow / ongoing glacial melt, snow accumulation and melt (rapid snow melting may also cause landslides) - As winters are projected to be drier and summers wetter, this could result in increased floods in summer when the river flows are higher and droughts in winter, when river flows are lower; and
- Wind: Higher wind speed and gusts of wind, in particular around the new Rogun HPP Reservoir.

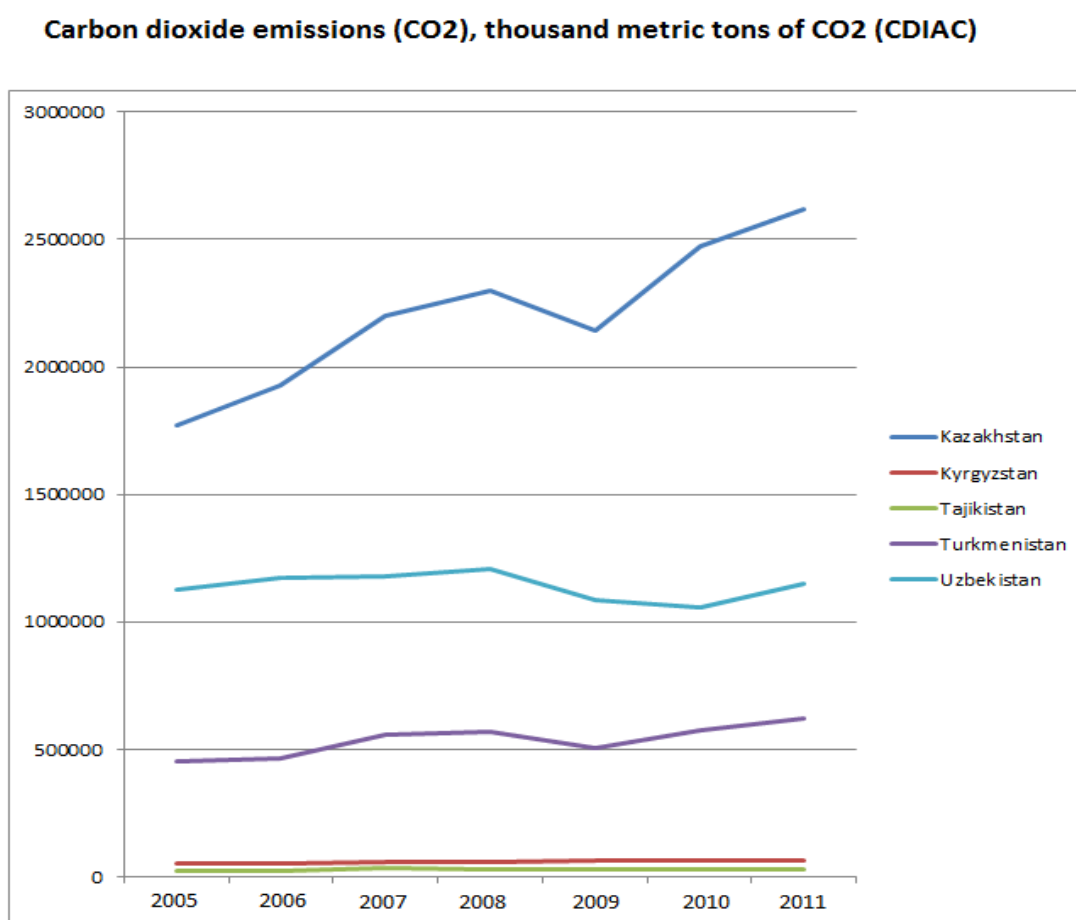
⁴⁴ For example, projected changes in temperature could decrease water levels in reservoirs, water reserves of glaciers and reduce the amount of snow cover in the mountains.

⁴⁵ For example, the increase in intensity of precipitation will aggravate mudflow, landslides and avalanches.

5.6 Greenhouse Gas Emissions

216. Since 2010 coal production has increased as a measure to address seasonal energy shortages and as a substitute for gas imports, which are often problematic. This coping strategy could lead to an increase in carbon emissions in the near future. From an environmental point of view, this is not ideal, however, a strong electricity deficit in the country, given population growth, will slow the pace of development and thus the ability to eliminate poverty.
217. In order to implement the United Nations Framework Convention on Climate Change (UNFCCC) commitments and strengthen measures for climate protection and adaptation, three national Communications on climate change have been issued in Tajikistan. Tajikistan is a pioneer in the preparation of a National action plan for climate change mitigation (2003), within its territory. The plan includes adaptation measures, many of which are being implemented and recommendations are being developed based on an updated National Action Plan.
218. Tajikistan's contribution to carbon emissions in Central Asia is currently low, see Figure 24 below. Despite the fact that the country does not have quantitative characteristics of the commitments of the UNFCCC to reduce emissions, the current level of emissions compared to 1990, decreased by one third, mainly due to the collapse of the Soviet Union and the structural changes resulting from the transition to a market economy and independence of the country. During the last decade, the level of carbon dioxide remains quite stable, but in the current decade emissions are expected to increase.

Figure 24: Carbon Dioxide Emissions by Countries throughout the region



Source: Carbon Information Analytical Centre as quoted on the web page: <http://mdgs.un.org/>

219. From the late 1990s to the present, agriculture has been the main source of greenhouse gas emissions in Tajikistan. Given the low level of mechanization, under-feeding of livestock, as well as the limited use of fertilizers, emissions from the agricultural sector of Tajikistan are lower than in other Asian and European countries. The potential for any substantial reduction in agricultural carbon emissions is therefore limited, while other measures of economic sub-industries are promising, especially in energy and industry.

5.7 Natural Hazards

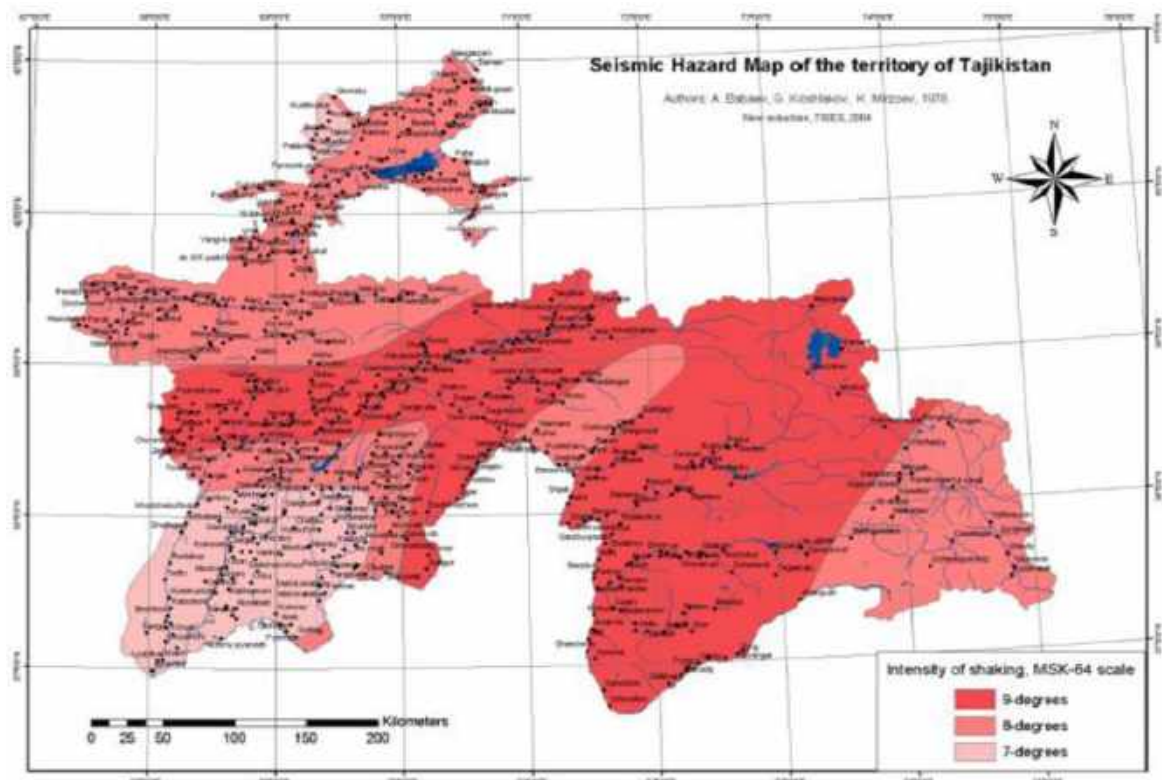
5.7.1.1 Seismic Conditions⁴⁶

220. Tajikistan has a relatively high seismic potential due to the active tectonic structure and its location within the thrusting tectonic border between the Indian and Eurasian plates. From a seismological point of view, the project road is located in the zone of 9-magnitude earthquakes on the Medvedev–Sponheuer–Karnik (MSK-64) scale (see Figure 25). The region is seismically active and categorised as a very high seismic hazard zone of PGA > 0.4g. This seismic hazard is due to tectonic zones and is confirmed by a long history of earthquake events in the last centuries.

⁴⁶ Information taken from Technical Assessment Report (Working Draft 1) Assessment of climate change risks to Vahdat – Kyrgyz Border Rehabilitation Project, Mott MacDonald, 31 May 2019; and

⁴⁶ Avtostrada Report Ref 16-16-AS.T03-CS-EN, 2017

Figure 25: Seismic Conditions in Tajikistan



Source: A.M. Babayev, T.A. Kinyapina, K.M. Mirzoev, R.S. Mikhailova and G.V. Koshlakov, 1978

221. The epicentres of the earthquakes indicate two active tectonic lines as visible on next two maps. The first line (largest earthquakes) goes roughly in North – South direction and is close to the Road alignment (see Figure 26).

Figure 26: Historical large earthquakes in wider Central Asian region



Source: <https://earthquaketrack.com/p/tajikistan/biggest>

222. The second line goes in a northeast – southwest direction. It is located in the area where the Rasht earthquakes took place: the first one 70 years ago with the magnitude of 7.5 and the second one 112 years ago with the magnitude of 7.4 (see Figure 27).

Figure 27: Historical large earthquakes in Tajikistan



Source: <https://earthquaketrack.com/p/tajikistan/biggest>

223. The epicentres of these huge earthquakes are geographically close to the Project Area. In general, there are some natural periods between large quakes in the area; it is far from being precise but could be accepted as an indication of an increased risk. If the period between these two last earthquakes was 42 years and the time since the last one is 70 years, one can estimate a new earthquake is likely in the near future.

224. The territory of Tajikistan is still seismically active, and from January – May 2019, 9 earthquakes with magnitude above 4 were recorded (Figure 28)

Figure 28: Significant earthquakes with magnitude above 4 in Tajikistan in 2019



Source: <https://earthquaketrack.com/tj-00-rasht/recent>

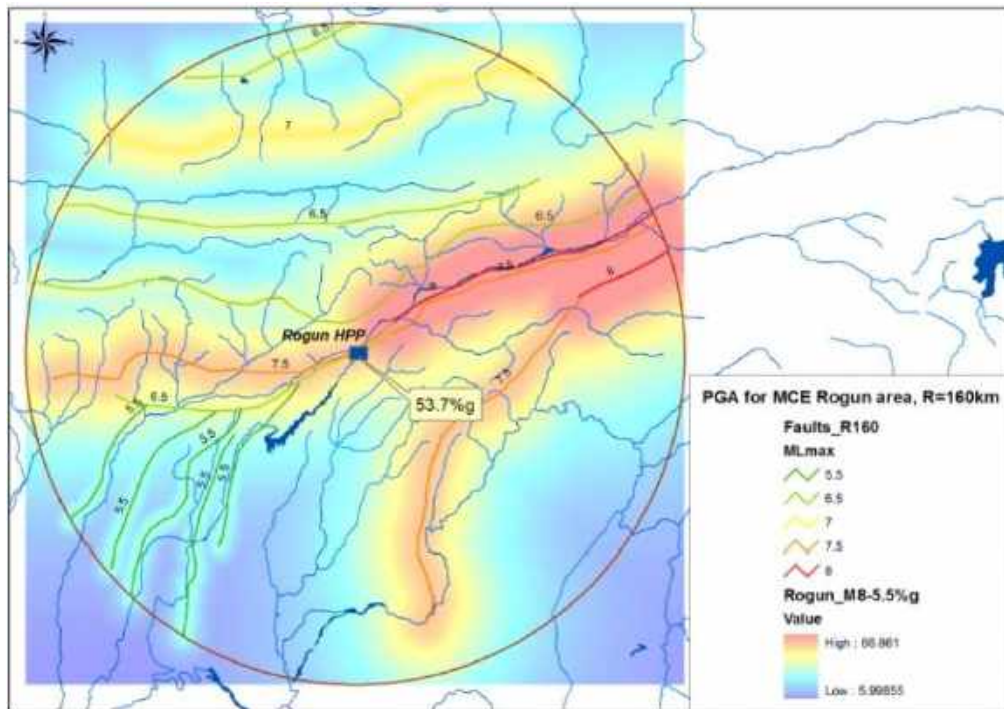
225. Engineering geological surveys⁴⁷ conducted by Avtostrada for the Tagikamar Tunnel indicate that the Vakhsh fault is located 8.0-8.1 km south of the tunnel and belongs to the active Holocene faults with a seismogenic structure of moment magnitude (Mw) 7.9-8.5. The estimated peak ground acceleration is

⁴⁷ Avtostrada Report Ref 16-16-AS.T03-CS-EN, 2017

0.50 g (taking into account the 10 % probability of exceeding every 50 years). Figure 29 shows the seismic hazards in the project area.

226. In the zone of the tunnel, faults have been found that have radial cracks that intersect the axis of the tunnel, the main effect is caused by the surrounding rock and abundant infiltration of water.

Figure 29: Assessment of the seismic hazard of the construction area in units of maximum peak ground acceleration (PGA)



Source: Avtostrada Engineering Geological Survey (Tajikamar Tunnel) 2017

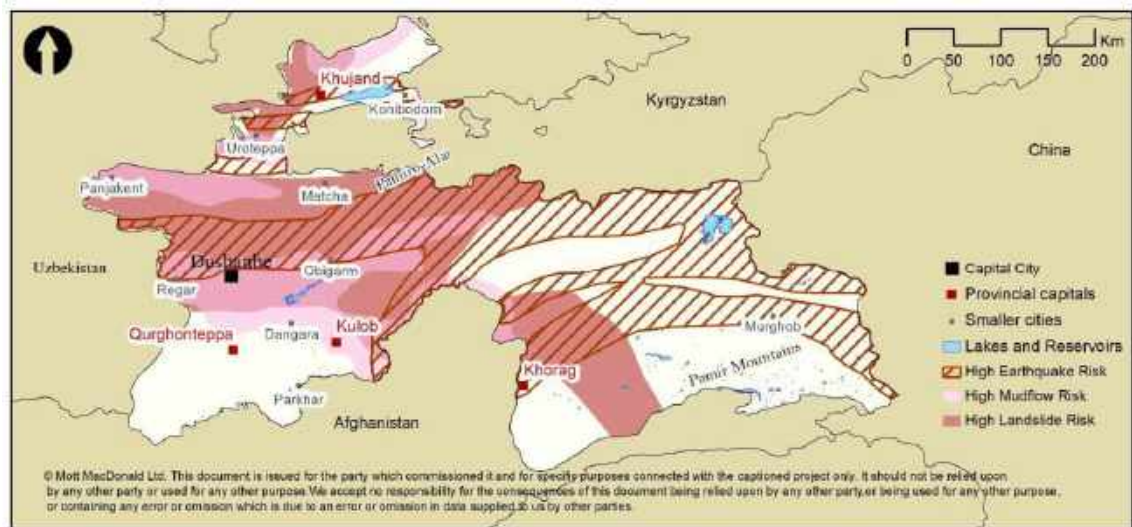
5.7.1.2 Landslides, Mudflows and Floods

227. In the 1990s, about 50,000 landslides were recorded throughout the country, including seismically hazardous and non-hazardous areas, with the highest concentration occurring in the western and central parts of the country. Landslides as a result of earthquakes are caused by strong earthquakes, and they are much more powerful than landslides of other origin.

228. Figure 30 shows areas most frequented by different types of seismological natural hazards. The most at risk region in Tajikistan is located in the west-central and northern parts of the country, including a broad belt extending from the western boundary through the capital Dushanbe towards the northeast, and including parts of the project area.⁴⁸

⁴⁸ Country Note on Tajikistan (Final) Assessment of Risks to Transport Infrastructure of Climate Change in Central Asia, Mott MacDonald, 21 August 2018

Figure 30: Seismological natural hazards areas in Tajikistan



Source: Country Note on Tajikistan (Final) Assessment of Risks to Transport Infrastructure of Climate Change in Central Asia, Mott MacDonald, 21 August 2018

229. The Avtostrada Engineering Geology Surveys indicate that landslides of various types occur in the Project area. Landslides in bedrock are generally shallow but can cover a large area. The largest of them are confined to tectonic zones. Landslides are often flooded and on outlets of underground waters such as springs.

230. Landslides with fatalities have occurred, notably:

- Chainage 43+30-45+60 – In 1990 there was a slope slipping due to provocation by slope cutting
- Chainage 371+65-391+00 – In 1992, an active occurrence of a landslide with casualties among the population of a nearby village. Further activation of the landslide is possible. The slip step height is 18 m. The whole body of landslide is permeated by springs of underground action

231. Landslides of a complex type are also known in the area, either due to merging of old landslides, compounded types of displacement (e.g. a rockfall that falls into a landslide area), or ancient landslides the type of displacement of which cannot be currently determined. The surface of landslide bodies is diverse. The slip steps are clear. In the landslide bodies are often outlets of groundwater. The reason for the formation of these landslides is difficult to estimate.

232. Mudflow forming factors in the area are as follows:

- availability of steep-sided terrain with large slopes of riverbeds;
- large reserves of loose material on the slopes and river beds;
- significant rainfall in the spring.
- all the rivers and gullies in the project road construction section are at risk of mudflows.

233. The Avtostrada Engineering Geology Surveys⁴⁹ identified locations along the route where there is potential for dangerous geological processes (landslides and mudslides). These are discussed in 7.3.6 and background data presented in Annex 3). The Engineering Geology Surveys for Bridges 9, 11, 12 and 13⁵⁰ identified the following:

- Landslide processes appear at the site of Bridge 13 over the Kalod River. The pillars on the left, right banks and in the bed of the river are on the path of the mudflow of mud.
- At the construction sites of Tegirmi-1 and Tegirmi-2 (Bridges 11 & 12), there are numerous outlets of springs. These locations are boggy, and standing water was present during the surveys.
- On the left bank of Bridge 9 over the Mirzosharifon River, loam overburden deposits on a rocky foundation can slide onto the designed road.

234. The hydrology reports developed for Avtostrada⁵¹ note the following with regards to mudslides along the alignment:

- Kandak / Guliston River – Bridge 1 – Erosion processes are mainly represented by earthflows, as well as landslides on the lower parts of the valley slopes. The existing bridge crosses the middle part of the river and the main supplier of solid material that provokes the formation of mudflows is the right slope and landslides.
- Gazakiyon River – Bridge 2 – The slopes of the valley are steep, dissected by small gullies and erosion depths that form a debris cone as a result of avalanche and mudflow activities. These cones are the main source of solid material to the Gazakiyon River. Solid material, randomly deposited, form ridges characteristic of the mud deposits.
- The Hakimi River – Bridge 5 – The main source of solid material, the accumulation of which provokes mudslides, is the lateral tributaries. Slope landslides block the river, creating a sub-reservoir which breakthrough resulting in significant material movement. The channel on the bridge section is weakly sinuous, with boulder-pebble material deposited on the extended sections, forming powerful ridges that prevent the passage of mudflow floods.
- Tagikamar River – Bridge 6 – The surface of the catchment area is significantly eroded. The presence of sharp turns, landslides create conditions for mudflows. A powerful mud-stone flow in August 1961, formed after a landslide, destroyed the houses and gardens of Leiron village.
- Chepakdara River – Bridge 7 – In the channel there are traces of small ridges of accumulations of channel sediments, which indicate the passage of mudslides along the river.

⁴⁹ Vahdat – Rasht – Jirgatal – Kyrgyzstan Border Road (From km 72 to km 158), Stage II Road Section From Chainage 424+80 To Chainage 759+14: Technical Report On The Results Of Engineering-Geological Surveys For The Development Of Working Design: Ref 16-16-Egs, Dushanbe, 2018; and Vahdat – Rasht – Jirgatal – Kyrgyzstan Border Road (From km 72 to km 158), Stage II Road Section From Chainage 0 to Chainage 424+80: Technical Report On The Results Of Engineering-Geological Surveys For The Development Of Working Design: Ref 16-16-Egs, Dushanbe, 2018

⁵⁰ Vahdat – Rasht – Jirgatal – Kyrgyzstan Border Road (From km 72 to km 158), Bridges Nos 9, 11, 12, 13: Technical Report On The Results Of Engineering-Geological Surveys For The Development Of Working Design: Ref 16-16-EG-T, Dushanbe, 2018

⁵¹ Report Reference 16-16-EGI (in 2 parts), undated

- Mujikharv River – Bridge 8 – The tributaries of the river are mudflows and almost all form debris cones from weakly bound rubble and boulder. With the passage of floods along the main river, the cone is easily eroded and can collapse into large channels in large blocks, replenishing the solid phase of the stream. With the passage of mudflows, tributaries directly deliver solid material to the mainstream. Frequency of passage along the river of powerful mudflows every 7-10 years. Of the intersected water courses, the Mudzhikharv River has the most mudslides.
- Tegermi River – Bridges 11 and 12 – An extreme mudflow event along the river occurred on the 6th June 1990 with a height of about 7 m and hit the village and causes significant damage to the upper parts. In the lower part, due to the expansion of the riverbed, the mudflow spread and caused silt deposits within the houses. The collapse is understood to have occurred in the upper reaches of the river, which blocked the narrow channel of the river, which led to a further breakthrough of the blockage. It is thought that significant damage could have been avoided if the restricted area had been observed by the residents, and housing was not built as close as it was to the river. The crowding of the buildings also caused channelling of mudflow which increased its power. The large-scale destruction caused is believed to be more of a result of unsuitable positioning of properties as opposed to the power of the mudflow itself.

235. Floods are probably the most frequent natural hazard within Tajik territory. Floods caused by snow and glacier thawing and late spring-summer heavy rains happen annually with increasing frequency. The regions around foothills, surrounding large rivers and lowlands are most prone to floods.

236. In Tajikistan, floods and associated debris flows are caused by intense rainfall greater than 20 mm per day. Debris flows most commonly occur in mountainous regions and foothills at altitudes usually up to 2,000 m asl. Debris flows are often generated in April-June in the snow-rain along with snow-glacier river watersheds. The latter have a shorter duration but cause great damage.

5.8 Noise and Vibration

5.8.1 Noise

237. The project road crosses a mountainous landscape, with small villages along the alignment. The project corridor does not have industrial sources of noise pollution, vehicle movements are rare and the noise environment is quiet, typical of a sparsely inhabited, rural upland area.

238. Villages on the alignment contain, residential buildings, schools and places of worship (mosques) that are particularly sensitive to noise pollution.

239. To determine actual conditions on the alignment, physical monitoring of the ambient noise has been conducted as part of this study. Site visits carried out in August and November 2018 had determined that the alignment was free from any sources of industrial pollution and that vehicle were almost absent from the alignment. The noise environment appeared homogeneous along the alignment. The only pollution sources were from villages on the alignment with limited noise.

240. To characterise the alignment noise environment, monitoring stations were identified.

- At the suburban areas close to Obigarm (Kandak)
- At the suburban areas close to new town development at Darabad; and
- Five intermediate points where there was a concentration of development – all in river valleys.

241. Sensitive sites along the alignment were identified, and ambient baseline monitoring was undertaken at these locations from 03 to 10 October 2018:

- Jamoat Obigarm, Gurun village, school number 6;
- Jamoat Sicharog, kishlak Lugur, 200 m from the alignment;
- Khamimi Jamoat, Sadokat kishlak, 800 m from the alignment;
- Jamoat Mudzhikharf, kishlak Mudzhikharf, 300 m from the bridge under construction number 8;
- Jamoat Komsomolabad, Tutkhor village, 150 from the alignment;
- Safedchashma Jamoat (Samsolik), Safedchashma kishlak, 100 m from the alignment; and;
- The urban-settlement of Darband, at the eastern end of the alignment.

Table 18: Ambient Noise Monitoring Locations

No	Measurement points	Latitude	Longitude	Elevation, m
AN1	Near school №6 Gurun village	38°45'12.55"	69°42'8.25"	1778
AN2	Lugur	38°47'42.32"	69°45'3.43"	1641
AN3	Hakimi settlement Sadokat	38°50'35.77"	69°48'50.03"	1415
AN4	Mujikharf	38°51'59.41"	69°52'44.51"	1335
AN5	Komsomolabad, village Tutkhor	38°52'45.72"	69°57'45.82"	1333
AN6	Safedchashma	38°52'38.97"	69°57'40.89"	1459
AN7	Urban village Darband, 7 mkr	38°54'38.73"	70° 7'15.63"	1383

242. The location of the noise / air quality monitoring points is shown on Figure 31.

243. Monitoring was carried out, every 3 hours for 24 hours.

244. The results of the noise level showed, as would be anticipated, that the noise level readings at night are lower than during the day. In the course of field research, 220 noise level measurements were carried out at 7 points. Average daily noise readings are shown in Table 19 and the full data set is presented in Annex 4.

Table 19: Results of the Noise Monitoring Exercise

	Location	Tajik Standards (dB(A))		Daily Average			Notes
		07:00 – 23:00	23:00 – 07:00	Daytime 07:00 to 19:00	Evening 19:00 to 23:00	Nighttime 23:00 to 07:00	
1	Jamoat Obigarm, Gurun village, school #6	55	45	42.3	39.9	38.5	Wind speed 0.8-1.2 m/s
2	Jamoat Sicharog, Lugur village, 200 m far from alignment			41.5	40.7	39.4	Wind speed 1.2-1.5 m/s
3	Jamoat Hakimi, village Sadokat, 800 m far from alignment			45.4	45.3	41.4	Wind speed: calm
4	Jamoat Mujiharf, village Mujiharf, 300 m far from the bridge No.8			47.0	47.6	42.6	Wind speed 1.8-2.3 m/s
5	Jamoat Komsomolabad, village Tutkhor, 150 m far from alignment			51.2	50.9	44.3	Wind speed 1.8-2.1 m / s
6	Jamoat Safedchashma (Samsolik), village Safedchashma, 100 m from alignment			46.3	44.15	44.1	Wind speed 1.5-1.8 m / s
7	Urban village Darband, eastern outskirts, km 152			50.35	56.7	54	Maximum wind speed of 5-7 m / s Note 1 Windspeed exceed allowable

Note 1) Noise monitoring is suspended when windspeed exceeds 5m/sec as the passage of air over the microphone generates “noise”.

Note 2) A full set of noise data is included in Annex 4

245. Based on the results of the monitoring exercise, the noise levels detected along the project corridor are “unaffected by noise sources”. The maximum of 60 dBA on the

eastern outskirts of Darband was recorded at relatively high wind speed (5-7 m / s) and as such has been discounted.

5.8.2 Vibration

246. At the west end of the alignment, close to Obigarm, there are buildings constructed in blockwork, in particular new government buildings e.g. schools at the east end of the alignment there were fewer concrete block buildings and more traditional mud brick construction. At Darabad, the new town at the east end of the alignment buildings were predominantly concrete blockwork. Many of the buildings are constructed within compounds of mud brick, blockwork or steel sheeting. Buildings were casually observed to be in good to fair condition and did not appear to be suffering from surface cracking due to ground settlement / poor foundations.

Plate 1: Residential building - wood frame mud brick walls and steel roof



Plate 2: Buildings in Kandak - west end of the alignment (Nov 2018)



Plate 3: Buildings in Kandak are generally set back from the alignment (Nov 18)



Plate 4: School Building (no 6) Kandak village (Aug 2018)



Plate 5: Wood framed / mud walled building in Kandak (Aug 2018)



Plate 6: Blockwork construction in Darabad new-town - east end of alignment (Nov 18)



5.9 Air quality

247. The project road crosses a mountainous landscape, with small villages along the road. The project corridor does not have industrial sources of pollution; therefore, the main source of air pollution in the region is the burning of fossil fuels for heating and cooking. Another source of emissions into the atmosphere can be divided into two categories: exhaust gases from motor vehicles and dust raised by motor vehicles, though site observations in August and September revealed few motorized vehicle movements on the alignment. Foot traffic and donkey carts were observed to be the favoured mode of moving on the alignment at this time.
248. Exhaust emissions to the atmosphere at the current level are relatively low. It should be noted, as shown in Figure 24, that Tajikistan's contribution to carbon dioxide emissions across Central Asia remains negligible. Any increase in emissions from vehicles as a result of operating the of the new alignment is unlikely to notably increase Tajikistan's contribution to emissions across the region.
249. The Law on the Protection of Atmospheric Air establishes the basic principles of the protection and rational use of the atmosphere in the country, economic mechanisms and responsibilities, as well as the directions of activity of state bodies.

Figure 32: Tajikistan Air Quality Standards

Pollutant	Tajikistan Standard (mg / m ³)*
Suspended particles	0.15
Nitrogen oxide (NO)	0.06
Nitrogen dioxide (NO ₂)	0.04
Sulphur dioxide (SO ₂)	0.05
Carbon dioxide (CO ₂)	3.00

* See Table 7 for comparison between Tajik and international air quality standards

250. To determine actual conditions on the alignment, physical monitoring of the ambient air quality has been conducted as part of this study. Site visits carried out in August and November 2018 had determined that the alignment was free from any sources of industrial pollution and there were very few vehicles using the alignment. The air quality environment appeared homogeneous along the alignment. The only pollution sources were from villages on the alignment with limited air quality impacts from fuel burning.
251. Air Quality baseline monitoring was carried out from 03.10.2018. to 10.10.2018. Six parameters were monitored: Inorganic dust (TSP); nitrogen oxides (NO₂ + NO); Carbon monoxide (CO); Carbon dioxide (CO₂); and Sulphur dioxide (SO₂).
252. To characterise the alignment air quality, monitoring stations were identified.
- At the suburban areas close to Obigarm (Kandak)
 - At the suburban areas close to new town development at Darabad; and
 - Five intermediate points where there was a concentration of development – all in river valleys.
253. Sensitive sites along the alignment were identified, and monitoring was undertaken at these locations:
- Jamoat Obigarm, Gurun village, school number 6;
 - Jamoat Sicharog, kishlak Lugur, 200 m from the alignment;

- Khamimi Jamoat, Sadokat kishlak, 800 m from the alignment;
- Jamoat Mudzhikharf, kishlak Mudzhikharf, 300 m from the bridge under construction number 8;
- Jamoat Komsomolabad, Tutkhor village, 150 from the alignment;
- Safedchashma Jamoat (Samsolik), Safedchashma kishlak, 100 m from the alignment;
- The urban- settlement of Darband, eastern suburbs, km 152.

Table 20: Air Quality Monitoring Locations

Nº	Measurement point	Latitude	Longitude	Elevation (m)
AN1	School №6, Gurun village	38°45'12.55"	69°42'8.25"	1,778
AN 2	Lugur	38°47'42.32"	69°45'3.43"	1,641
AN 3	Khakimi s. Sadokat	38°50'35.77"	69°48'50.03"	1,415
AN 4	Mujikharv	38°51'59.41"	69°52'44.51"	1,335
AN 5	Komsomolabad, Tutkhor	38°52'45.72"	69°57'45.82"	1,333
AN 6	Safedchashma	38°52'38.97"	69°57'40.89"	1,459
AN 7	s. Darband	38°54'38.73"	70° 7'15.63"	1,383

254. The location of the air quality monitoring points is shown on Figure 31.

255. The main sources of emissions to the environment in the project area were observed to be from fuel for heating and cooking, and limited vehicle emissions.

256. The results of testing the quality of the atmospheric air for the period from 03.10.2018 to 10.10.2018 are shown in Table 21. Testing times: 02:00, 04:00, 07:00, 10:00, 13:00, 17:00, 20:00, 23:00.

Table 21: Results of Air Quality Monitoring Exercise

##	Parameters	Tajikistan standard (PDK), mg/m ³ *	Baseline indicators		
			Daytime 06:00-12:00	Night time 12:00-05:00	Daily averages
1	Inorganic dust (TSP)	0.15	0.0075	0.0063	0.0069
2	Amount of nitrogen oxides (NO ₂ + NO)	0.085	0.0107	0.0056	0.0081
3	Carbon monoxide (CO)	3.0	0.0033	0.0021	0.0027
4	Carbon dioxide (CO ₂)	3900	685,00	346,00	515,00
5	Sulphur dioxide (SO ₂)	0.05	0.0066	0.0056	0.0061

* See Table 7 for comparison between Tajik and international air quality standards

257. Testing has shown that the concentration of harmful substances at night is relatively lower than during the day, which is likely to be due to fewer vehicle movements and less fuel usage. As can be seen from Table 21, the content of harmful ingredients in the project corridor of the Obigarm-Nurabad road is much lower than the permissible norms (MPC) of the standard of Tajikistan and also the international standards identified in Table 7.

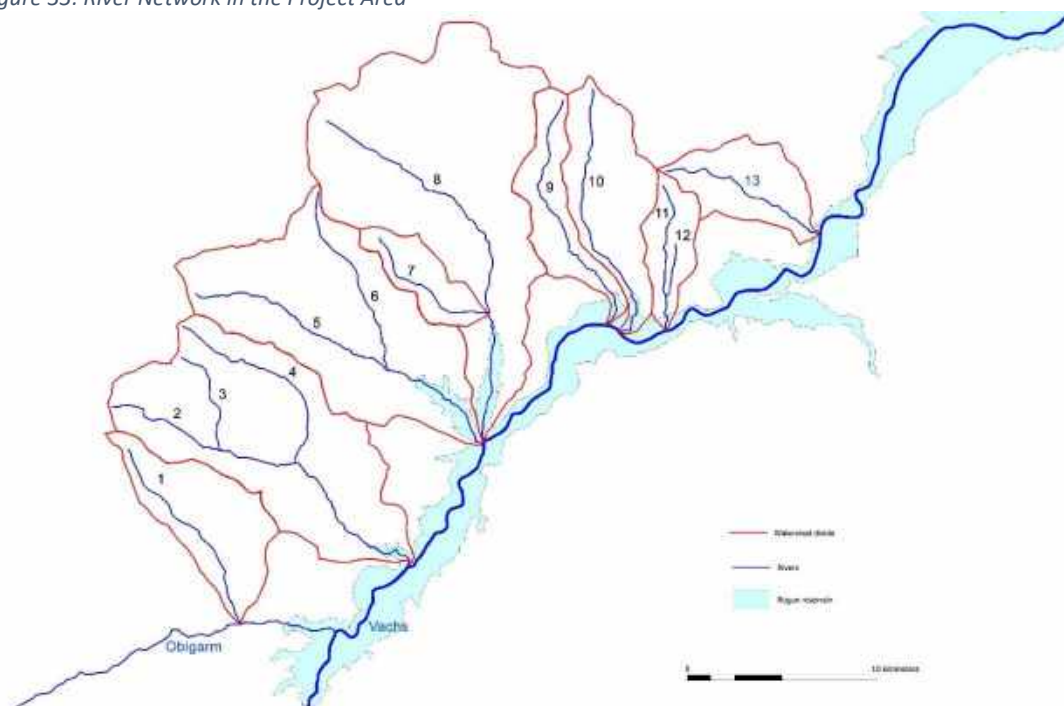
5.10 Hydrology and Water Quality

5.10.1 Hydrology

258. The entire hydrographic river network in Tajikistan belongs to two basins: the Amu Darya and the Syr Darya. The project road region belongs to the first basin – Amu Darya. The Vakhsh is the main river of the region, downstream of the project area it from the Amu Darya river, which flows into the Aral Sea.
259. The length of the Vakhsh river is 524 km. It is formed by the confluence of the rivers Kyzylsu (in the northern part), originating in the Alai valley of Kyrgyzstan, and the Muksu, originating in the centre of the Pamirs Fedchenko glacier. After the confluence of the rivers Kyzylsu and Muksu form the Surkhob River, which merges with the river Obihingou, called Vakhsh. The Vakhsh is fed by many tributaries, including the: Obi-kabud, Obi-Yasman, Kamarob, Mirzosharipov, Dasht Gorgan, Kalakan, Thermi, Lugur, Hakimi, Mujikharf etc. All these rivers are of a snow-glacial origin and therefore their greatest flows occurs at the end of June-July.
260. The alignment begins after Javoni River, and is located in the mountainous terrain on the northern side of the Vakhsh River valley, crossing the south-eastern and eastern spurs of the Karategin Range. The river network in this part of the Project Area is represented by the main tributaries of Vakhsh River, namely the: Dashtiguron, Mirzosharifon, Mudzhikharv, Hakimi, Tegermi, Kalot and their tributaries - permanent watercourses, and numerous gullies⁵².
261. The tributaries of these rivers are mainly temporary and the perennial flow on individual tributaries in the summer period is due to springs located in their basins.
262. In all the rivers, two periods are clearly distinguished in the annual flow: spring-summer high water and autumn-winter low water with the difference in the regime of the rivers being the predominance of the feed source. The high water flows in the rivers, depending on the altitude, begins in February - March, and ends due to snow cover in July and August. The length of the period of high water flow is approximately from 100 to 200 days, although this also depends on the catchment area. During this time, the majority of the annual runoff flows down the rivers. The highest annual discharges are in April-May and, as a rule, are of rainfall.
263. The main reason for the intense surface runoff and the large maximum discharges in the Project Area, is the intense heavy rainfall or prolonged wide-spread rains, turning into heavy rain.

⁵²Technical Assessment Report (Working Draft 1) Assessment of climate change risks to Vahdat – Kyrgyz Border Rehabilitation Project, Mott MacDonald, 31 May 2019

Figure 33: River Network in the Project Area



Legend: 1 Daraidegdon, 2 Gazakiyon, 3 Zuriyon, 4 Sebnok, 5 Hakimi, 6 Tagikamar, 7 Chepakdara, 8 Mujikharv, 9 Mirzosharifon, 10 Dastiguron, 11 Tegirmi I, 12 Tegirmi II, 13 Kalot

Source: *Technical Assessment Report (Working Draft 1) Assessment of climate change risks to Vahdat – Kyrgyz Border Rehabilitation Project*, Mott MacDonald, 31 May 2019

264. The area of the Surkhob and Vakhsh rivers basin is composed mainly of sedimentary rocks of clay slates with red sandstones.
265. In winter, the river Surkhob and Vakhsh do not freeze over. In general, it has a positive impact on the climate in the region, which is warming and increases the overall humidity. Thus, in winter the banks of the Nurek reservoir do not have snow cover.
266. Hydrology reports developed for Avtostrada53 indicate that, in all rivers there are two distinct flow patterns; spring - summer high flows and autumn-winter low flows. The high flows start at slightly different times of the year depending on the altitude. The spring season typically starts between February and March in the form of snow fall. The highest flows typically occur in April – May as a result of rainfall. During this period, the risk of mudflows is increased. The minimum flow of the river is determined by groundwater reserves in the river catchment area and the conditions for its release into the river valley and channel. On permanently operating watercourses in the study area low flow rates vary between 0.20 and 1.0 m³/s.
267. These hydrology reports also provide the following summaries of the characteristics of each tributary at the locations where they cross the alignment. The information on mudflows is also summarised in the Natural Hazards baseline, section 5.7.
268. Kandak / Guliston River – Bridge 1

⁵³ Report Reference 16-16-EGI (in 2 parts), undated

- The left tributary of the Obigarm River originates on the south-eastern spur of the Karategin Range, called the Daraidegdon. The relief of the left slope is steep and uneven, but it is also characterised by relatively smooth relief forms. The soil cover is represented by mountain type soils (loamy in texture). Rocky outcrops are rare and do not form significant masses.
- Erosion processes are mainly represented by earthflows, as well as landslides on the lower parts of the valley slopes. Vegetation cover is represented by dense grass vegetation. Tree-shrub vegetation is sparse, but on the slopes of the northern exposures there are dense thickets of bushes.
- The existing bridge crosses the middle part of the river and the main supplier of solid material that provokes the formation of mudflows is the right slope and landslides.

269. Gazakiyon River – Bridge 2:

- This river originates from a group of springs located on the south-eastern slopes of the Karategin Range.
- The relief of the basin is mountainous and sharply dissected. Virtually the entire surface is covered with sodded loam, pierced, in places, by small rocky outcrops.
- The river has a well-developed V-shaped valley. The width of the valley along the bottom varies from 80 to 200 m. The slopes of the valley are steep, dissected by small gullies and erosion depths that form a debris cone as a result of avalanche and mudflow activities. These cones are the main source of solid material to the Gazakiyon River. Solid material, randomly deposited, form ridges characteristic of the mud deposits.
- On the bridge section, the left bank is represented by a terrace with a height of 8–9 m, the right one - by a low, narrow floodplain.

270. Zuriyon River – Bridge 3:

- The catchment is covered with loam. Small outcrops of rocks are registered in the watershed sections of the catchment.
- Along the entire length of the river, the valley is V-shaped, its slopes are weakly dissected and the main negative forms of relief are small gullies and denudation funnels.
- In the lower course the valley expands and its bottom is occupied by agricultural lands. The channel is deeply embedded in the bottom of the valley and pressed against the right bank. The banks of the channel bowl are steep, cliffed in some areas and subject to erosion.

271. Sebnok River – Bridge 4:

- The valley is covered with well-sodded loams. Dense forest vegetation is represented by spots on the left side of the valley. Outcrops of rocks are small in size and do not significantly affect the formation of runoff.
- In the upper and middle courses, the valley has a V-shaped form. The slopes of the valley are dissected by small gullies. The channel is deeply embedded in the valley floor. The banks of the channel are steep and they are both bare, often with outcrops of rocks.
- In the alignment of the bridge, the channel does not exceed 15 m, the banks are steep and tall.

272. The Hakimi River – Bridge 5:

- This river originates on the north-eastern slope of the Karategin Range from a snowfield located in a shaded part of the valley. The basin extends towards the south-east in a triangular shape.
- Most part of the valley is covered with loess-like loams. Outcrops of rocky soils are observed only along the very steep slopes of the side valleys. Small areas of trees and shrubs are located on the valley slopes.
- The floodplain of the upper reaches of the river are vegetated and covered with boulders. This gradually becomes more active downstream gradually tapering and with less vegetation.
- The river bed is full of non-branched, winding rapids.
- The main source of solid material, the accumulation of which provokes mudslides, is the lateral tributaries. Slope landslides block the river, creating a sub-reservoir which breakthrough resulting in significant material movement.
- The existing road crosses the river in the middle of its course. On the bridge section the river valley has an asymmetric shape. The right slope is steep with rock outcrops while the left slope in the lower part is terraced and in the upper part it is gentler. The surface of the slopes are mainly sandy sediments with rock outcrops.
- The channel on the bridge section is weakly sinuous, with boulder-pebble material deposited on the extended sections, forming powerful ridges that prevent the passage of mudflow floods.

273. Tagikamar River – Bridge 6:

- The valley is V-shaped, the slopes are steep, the surface of which is represented mainly by sandy deposits with outcrops of rocks in the upper part of the catchment. Grass and shrub vegetation grows only along the bottom of the valley.
- In the river valley contains numerous erosion deposit cones and scree. The floodplain of the river is made up of boulders and pebbles. The riverbed in the upper courses is sinuous and contains sections of rapids while the lower part obtaining a rectilinear outline and reduced slopes.
- The bed in the extended areas is cluttered with boulder material that prevents the passage of mudflows.
- The surface of the catchment area is significantly eroded. The presence of sharp turns, landslides create conditions for mudflows.
- A powerful mud-stone flow in August 1961, formed after a landslide, destroyed the houses and gardens of Leiron village.

274. Chepakdara River – Bridge 7:

- The lower part of the catchment area is a typical mountain river with a ravine valley. The slopes of the valley are relatively gentle and poorly dissected. The developed channel is weakly sinuous but not branched. The shores are low, steep and mostly earthen.
- When the river leaves the upper part of the catchment area, the slope of the valley increases sharply, this turns into a steep rocky canyon. The slopes of the canyon are steep and considerably dissected. The bed in this part of the catchment area is eroded to bedrock, it has a stepped longitudinal profile.
- The road crosses the river a few tens of meters below its exit from the canyon. The left bank is a scree-shaped steep debris cone under the rock. The right bank is rocky, covered with loams through which the bedrock is traced. A rocky protrusion along the river divides the stream into two channels. In the channel there are traces of small ridges of accumulations of channel sediments, which indicate the passage of mudslides along the river.

275. Mujikharv River – Bridge 8:

- The river originates from a group of springs located on the south-eastern slope of the Karategin Range at the altitude of 3360 m and flows into the Vakhsh River near the village of Chorsada. The slope of the ridge is steep, devoid of vegetation, cut up by erosional depths and has small rocky outcrops, from which the debris creeps down.
- When exiting the mountainous terrain, the slopes of the valley sharply reduce with rocky slopes replaced by loam. The loessal karst phenomenon is developed in the river basin. Numerous craters and hollows associated with the circulation of groundwater are especially developed on the right side of the valley.
- The riverbed in the upper course is not branched, sinuous and stepped, in the lower course it obtaining more straightforward outlines and becomes somewhat quieter in the longitudinal profile.
- The tributaries of the river are mudflows and almost all form debris cones from weakly bound rubble and boulder. With the passage of floods along the main river, the cone is easily eroded and can collapse into large channels in large blocks, replenishing the solid phase of the stream. With the passage of mudflows, tributaries directly deliver solid material to the mainstream.
- Frequency of passage along the river of powerful mudflows every 7-10 years. Of the intersected water courses, the Mudzhikharv River is the most mudslide.
- The road crosses the river in its middle course, above the influx of the Chepakdara River. The channel here is not branched, the left bank is high and steep, the right one is represented by the Chepakdara fan and is lower and less stable.

276. The Mirzosharifon River – Bridge 9:

- This river originates at the altitude of 3450 m. The main tributary is Karchadara which flows adjacent to the village of Dagon. The slopes of the valley are eroded and supply significant amounts of material into the river bed. The valley is largely narrow with settlements located in the middle and lower parts where the valley widens.
- The basin is fed by multiple springs, which ensures relatively steady flows throughout the year. The riverbed is well developed and rectilinear in short sections.

277. The Dashtiguron River – Bridge 10:

- The river flows through a wide mountain valley, nestling on the right slope and obtaining a V-shaped form in the lower reaches. The right slope is steeper. In some areas the slopes are terraced and covered by crops and trees.
- The riverbed is well developed and meanders along its length. In the lower reaches of the river is used for irrigation.

278. The Tegermi River – Bridges 11 and 12:

- This river originates at an altitude of over 2500 m and flows along a well-developed channel in the upper part of the basin. Significant amounts of friable material (scree) covers the steep slopes of the valley. There is very little vegetation on the slopes which contributes to erosion and the formation of mudflows. The riverbed meanders but is relatively rectilinear just upstream of the village of Teghermi. In the village, the river abruptly changes direction and then flows through a wide scenic valley with spacious fields, gardens, and high grass pastures.
- In the wide part of the valley, the outcrops of springs partially swamp the terrain.

- An extreme mudflow event along the river occurred on the 6th June 1990 with a height of about 7 m and hit the village and causes significant damage to the upper parts. In the lower part, due to the expansion of the riverbed, the mudflow spread and caused silt deposits within the houses.
- The collapse is understood to have occurred in the upper reaches of the river, which blocked the narrow channel of the river, which led to a further breakthrough of the blockage. It is thought that significant damage could have been avoided if the restricted area had been observed by the residents, and housing was not built as close as it was to the river. The crowding of the buildings also caused channelling of mudflow which increased its power. The large-scale destruction caused is believed to be more of a result of unsuitable positioning of properties as opposed to the power of the mudflow itself.

279. The Kalot River – Bridge 13:

- This river flows through multiple small channels along a V-shaped valley with steep slopes and a relatively wide valley bottom. The channels expand at the mouth of the valley.
- The river is winding, with steep coastal slopes covered with a small cover of loams and overgrown with grass and sparse bushes. The width of the channel varies between 15 m in the shallows and 3 m with a depth of up to 0.4 m. There are multiple groundwater springs at the bottom of the valley which has led to agricultural uses.

5.10.2 Water Quality

280. Table 22 sets out the water quality standards for surface waters in Tajikistan.

Table 22: Tajikistan Water Quality Standards

Parameter	Limit value (MPC)*
Oxygen	winter – 4.0 mg/l, summer – 6.0 mg/l
Ammonium salts	0.5 mg/l
BOD5	3.0 mg/l
Oil products	0.05 mg/l
Iron	0.05 mg/l
Copper	0.001 mg/l
Zink	0.01 mg/l
Phenols	0.001 mg/l
Chlorides	300 mg/l
Sulphates	100 mg/l
Calcium	180 mg/l
Potassium	50 mg/l
Suspended particles	1000 mg/l
Coli-index	1000 pcs/l

281. * See Table 8 for comparison between Tajik and international water quality standards

Source: Goskomstat. Environmental protection in Tajikistan, 1990-2000, 2002 (in Russian)

282. To determine actual conditions on the alignment, physical monitoring of the water quality in streams has been conducted as part of this study. Site visits carried out in August and November 2019. The only pollution sources in these streams were from villages along the alignment, with some limited water quality impacts from domestic and agricultural waste discharges.

283. Water Quality baseline monitoring was carried out along the alignment, from 03.10.2018. to 10.10.2018, at the following nine locations:.

- Vakhsh river, at the bridge of Sicharog;
- Jamoat Obigarm, Kandak kishlak, Kandak spring (Guliston);
- Jamoat Sicharog, kishlak Lugur, river Lugur, below kishlak Lugur;
- Jamoat Hakimi, the village of Hakimi, Sadokat-Hakimi, after the bridge
- Jamoat Mudzhiharf 500 m, below bridge No.8;
- Jamoat Komsomolobad, small river Dashti Gurgon, outside the village of Tutkhor;
- Jamoat Safedchashma, small river Kalakon – tributary of Surkhob river, after Ulfatobod bridge;
- Vakhsh river, after confluence of the rivers of Surkhob and Khingob; and
- Urban village Darband, 500 m below the bridge which is being constructed over Surkhob river.

284. The location of the air quality monitoring points is shown on Figure 31 and defined in Table 23.

Table 23: Location of Water Quality Monitoring Points

No	Measurement point	Latitude	Longitude	Elevation (m)
WQ1	Vakhsh river	38°43'36.49"	69°48'30.65"	1,054
WQ2	settlement Kandak, spring Kandak	38°46'21.60"	69°41'13.77"	1,780
WQ 3	Lugur river, below the place of confluence of two rivers	38°47'34.87"	69°45'50.48"	1,532
WQ 4	Hakimi river, settlement Hakimi	38°50'2.63"	69°49'47.63"	1,296
WQ 5	Mujikharv river, village Mujikharvi Kalon	38°51'55.81"	69°52'44.19"	1,325
WQ 6	Dashti Gurgon river, Village Tutkhor	38°52'45.72"	69°57'45.82"	1,315
WQ 7	Kalakon river, tributary of Surkhob river	38°54'54.48"	70° 6'18.77"	1,193
WQ 8	Vakhsh river, after confluence of the rivers of Surkhob and Khingob	38°51'57.42"	70° 1'29.31"	1,160
WQ 9	Surkhob river, 500m below the bridge	38°54'38.73"	70° 7'15.63"	1,383

Table 24: Results of Water Quality Monitoring Exercise

	Parameter	MPC		Vakhsh river, near Sicharog bridge (WQ1)	village Kandak, spring (WQ2)	jamoat Sicharog, small river Lugur, 500m below village (WQ3)	jamoat Hakimi, village Hakimi, Sadokat-Hakimi, after the bridge (WQ4)	jamoat Mujikharv 500 m. below bridge №8 (WQ5)	small river Dashti Gurgon, outside village Tutkhor (WQ6)	tributary of Surkhob river, jamoat Safedchashma, after bridge Ulfatobod (WQ7)	Vakhsh river, after confluence of rivers Surkhob and Khingob (WQ8)	Surkhob river, 500 m below the bridge being constructed (WQ9)
		Domestic	Fishery									
				1	2	3	4	5	6	7	8	9
1	Temperature, °C			13.08	13.80	13.90	13.40	13.00	12.90	13,60	14,50	14,70
2	pH	6.5-8.5		8.86	8.86	8.87	8.77	8.45	8,92	8,96	8,89	8,85
3	Smell	Abs.	Abs.	0	0	0	0	0	0	0	0	0
4	Turbidity	1.5		153	3	6	7	3	6	3	160	175
5	Chromaticity			650	19	32	37	23	200	18	832	910
6	Mineralization, mg / l	1000	1000	425	160,00	156,00	186,00	183,00	200,00	270,00	487,00	498,0
7	Chlorides, mg / l	350	300	135,0	63,5	48,6	67,1	66,0	61,8	76,0	139,2	143,4
8	NITROGEN	-- ammonium, mg / l	2	0,39	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
9		-- nitrites, mg / l	1.0 (3.3 –NO ₂)	0,02	0.003	0,003	0.003	0,004	0,003	0,006	0,005	0,004
10		-- nitrates, mg / l	10.2(45-NO ₃)	9,1	0.019	0.020	0,020	0,010	0,020	0,020	0,030	0,020
11	Calcium, mg / l	-	180	93,5	48,1	46,1	57,1	60,3	59,1	62,1	97,0	96,6
12	Magnesium, mg / l	-	40	18,2	16,1	16,4	12,6	6,0	8,9	12,2	18,8	19,8
13	Divalent iron, mg / l	0.5	0,005	0,02	0,03	0,02	0,04	0,00	0,01	0,02	0,04	0,03
14	Salinity mg / l			0,33	0,11	0,11	0,13	0,13	0,14	0,19	0,34	0,35
15	Hardness mg-equiv./l	7		5,02	3,72	3,65	3,89	3,50	3,68	4,10	6,39	6,45
16	Alkalinity mg-equiv./l			29,41	20,04	26,21	36,07	28,87	35,50	35,00	19,45	19,40
17	Hydrocarbonate HCO ₃ mg/l			1950,00	1 222,84	1 599,33	2 200,99	1 761,65	2 166,21	2 135,70	1 186,84	1183,79
18	Sodium+Potassium mg-equiv./l			950,85	611,62	794,73	1 099,65	883,71	1 081,00	1 070,70	637,58	654,39
19	Sulphates mg / l	500	500	52,00	1,00	4,00	1,00	6,00	2,00	4,00	65,00	98,0
20	Dissolved oxygen, mg / l	He менее 4-6	He менее 4-6	8,8	10,0	8,7	9,0	8,9	9,2	9,1	8,4	8,5

21	Phosphates mg / l (PO4 -3)	3,5		0,205	0,390	0,210	0,380	0,290	0,300	0,610	0,160	0,180
22	Specific electrical conductivity, Ohm / cm			0,593	0,225	0,220	0,262	0,280	0,280	0,380	0,687	0,700
23	Dry residue, mg / l	1000	1000	420,630	157,900	154,920	184,750	181,860	196,200	269,400	485,780	174,120
24	Oil products, mg / l	0,05	0,05	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
25	Manganese, mg / l	0,5	0,5	0,000	0,000	0,000	0,000	0,004	0,000	0,001	0,000	0,000
26	Copper mg / l	1,0	1,0	0,0010	0,000	0,030	0,010	0,030	0,040	0,020	0,000	0,000
27	COD mg / l			6,000	7,050	6,200	7.330	5,940	6,250	7,120	6,860	6,240
28	BOD ₅ , mg / l	3,0	3,0	1,4	1,2	1,1	1,3	1,3	1,2	1,1	1,3	1,2
29	Suspended substances, mg / l	25	75	15	10	9	6	8	7	5	23	21
30	Coli-index, pcs / l	1000	1000	9	7	7	5	7	6	7	10	11

285. The results of chemical analysis show (Table 24) that the water quality of the Vakhsh and Surkhob rivers and their tributaries in the project area is good. The concentration of many parameters is an order of magnitude lower than the maximum permissible concentration (MPC). In the sample of water from the Vakhsh river taken from the bridge of Sicharog, the contaminant concentrations were relatively lower than in the sample taken after the confluence of the Surkhob and Hengov (the beginning of the Vakhsh river). This is due to the fact that the water tributaries of the Vakhsh river (PP. Safecase, mujiharf, Mirzosharipov, Hakimi, Lugur, Dasht Gorgan, Thermi, batters, etc.) are much cleaner than the Vakhsh river and its main tributaries, the Surkhob and Hengov, and because of the dilution of concentration of contaminants in the centre of the Jamoat Sicharog, is relatively lower than after the confluence of Surkhob and Khingov.
286. Long-term observations show that the concentration of suspended solids, mineralization and some other ingredients in the autumn-winter time (September-February) in the Vakhsh river near the town of Rogun is much lower than in the spring-summer period (March-July). In the season of intensive snow melting and heavy rains, the concentration of suspended solids in the Vakhsh river is much higher, and in some cases exceeds the MPC norm.

5.11 Habitats and Biodiversity

287. The project is located within an area characterized by habitats that exhibit signs of anthropogenic influence, to varying levels. Much of this is due to long-term grazing pressure and tree-clearance; this has resulted in a short grass sward, interspersed with herbs. Tree removal has also resulted in soil destabilisation and subsequent erosion.
288. The wider area is known to support ancient fruit/nut tree species, thought to be the ancestors of modern, commercial tree species. Elsewhere, cultivated fruit/nut trees are present within village gardens and smallholdings.
289. In areas where grazing pressure is reduced, more diverse habitat pockets exist, including meadow habitats, pockets of native woodland, and scrubby hillsides.
290. The Scheme also contains a number of riparian zones, of varying sizes (13 formal bridge crossings will be required as part of the Scheme, together with additional informal crossing points). The habitats here are relatively lacking in vegetation, reflecting the dynamic nature of the watercourses (i.e. subject to regular spate conditions).

5.11.1 Terrestrial Flora

291. Due to vertical zoning, scattered relief, diversity of climatic zones and soil cover in the country, there are more than 5000 plant species, and 7 geobotanical regions, in Tajikistan. All of them are confined to the absolute heights of the terrain, climate, orography of soil cover. In general, they coincide with the natural zoning of the country (Atlas of the Tajik SSR, 1968).
292. The project area is located within the lowlands belt. This belt is warm, and dominated by broad-leaved forests, shrubs, with areas of steppes and forest-steppe.
293. The most abundant flora across the project area are perennial grasses, generally of short sward, and indicative of ongoing grazing practice in the

region. In areas where grazing pressure is less pronounced, a lush grass sward prevails, with herbs and shrubs also present.

294. Grass-bearing wheatgrasses dominates in the grassy cover. At higher altitudes, this gives way to tree-shrub vegetation, which consists of almonds (*Amygdalus bucharica*), hawthorn (*Crataegus pontica*), small-leaved maple (*Acer regelii*), carcase (*Celtis caucasica*), and chion (*Zuzyphus jujuba*). Grassy cover is completely dominated by wheatgrass (*Elytrigia trichospora*), barley (*Hordeum bulbosum*), viviparous bluegrass (*Poa bulbosa*), palate (*Cynodon dactylon*), bearded (*Bortriochloa ischaemum*). At lower levels (i.e. in the gorges and floodplains) walnut, apple, poplar and willow are common.
295. In the upper part, a belt of tree-shrub vegetation and juniper is suitable for this belt. In the valley of Vakhsh and Surkhoba a comb-dwelling, willow and sea-buckthorn grow.
296. On the territory of this belt many herbs of medicinal importance grow. Some of them are harvested, both by local residents and forestry workers. These herbs are milfoil (*Alhaca armeniaca*), Althaea officinalis (*Alhaca officinalis*), wormwood (*Artemisia absinthium*), shepherd's purse (*Capsela bursa-pastoris*), caraway (*Carum carvi*), Adonis turkestanica (*Adonis turkestanicus*) and many others.

5.11.2 Terrestrial Fauna

297. Faunal diversity across the Scheme (and wider area) is diverse, with numerous animal groups represented. The presence of key faunal species (i.e. those of increased conservation concern) will vary through the year depending upon prevailing weather conditions, as well as other influences such as local livestock movement.
298. Amphibians - In Tajikistan, there are 2 species of amphibians - the green toad (*Bufo viridis*) and the lake frog (*Pelophylax ridibundus*). Both species are found in the Project area. The green toad (*Bufo viridis*) is spread quite widely and can live up to 4000 m, the project alignment is located at a height of approximately 1300 m to 1600 m asl. This species only needs water during the breeding season, in which it lays its eggs. For the habitation of the lake frog (*Pelophylax ridibundus*), year-round ponds with stagnant water are necessary and preferably warmed up in the warm season, where it constantly lives, hides, reproduces and spends its winters. Both species play an important role in maintaining the ecological balance and feed on invertebrates. Their extinction is a recognition of the violation of ecological equilibrium and both of these species are key in the country's existing ecosystems.
299. Reptiles - Around 47 species of reptiles are considered likely to inhabit the project area, including snakes, lizards, and a single tortoise species. Typical for this region are species such as Transcasian bent-toed gecko (*Cyrtopodion russowii*), and Turkestan agama (*Laudakia lehmanni*) that live at altitudes up to 2000 m. In terms of snakes, water snake (*Natrix tessellata*), a multicolored snake (*Hemorrhois ravergieri*), sand boa (*Eryx miliaris*) and coluber (*Elaphe dione*) are all likely to be present. Furthermore, the venomous viper (*Macrovipera lebetina*), listed in the Red book of the Republic of Tajikistan (2015, 2017) may also occur. A single tortoise species – Russian tortoise (*Testudo horsfieldii*) was observed close to the project.

300. Birds - The bird fauna is extremely rich here. Of the 400 species of birds in Tajikistan, about 150 species can be found here, of which 56 species nest in the area. The characteristic nesting birds here are chukar partridge (*Alectoris kakelik*), blue-rock thrush (*Monticola saxatilis*), mountain swallow (*Ptyonoprogne rupestris*), rock nuthatch (*Sitta neumayer*), rock dove (*Columba rupestris*), and alpine swift (*Apus affinis*).
301. In the scree slopes, the colonially nesting pink starling (*Sturnus roseus*) can occur. In places where shrubs and trees are more common, blackbird (*Turdus merula*), daraba (*Turdus viscivorus*), Oriental turtle dove (*Streptopelia orientalis*), magpie (*Pica pica*), paradise flycatcher (*Terpsiphone paradisi*), the yellow-browed warbler (*Phylloscopus inornatus*), red-backed shrike (*Lanius collurio*), grey-headed goldfinch (*Carduelis caniceps*), streaked laughing thrush (*Trochalopteron lineatum*), Cetti's warbler (*Cettia cetti*), golden oriole (*Oriolus oriolus*) and many others are all present. Predatory birds present within the project area include golden eagle (*Aquila chrysaetos*), Egyptian vulture (*Neophron percnopterus*), lesser kestrel (*Falco naumanni*), sparrowhawk (*Accipiter nisus*), hobby (*Falco subbuteo*), peregrine (*Falco peregrinus*), booted eagle (*Hieraetus pennatus*). Additionally, during a cattle drive, species such as griffon vulture (*Gyps fulvus fulvus*), black vulture (*Aegypius monachus*) and sometimes bearded vulture (*Gypaetus barbatu*) will be present.
302. Mammals - There are 84 species of them in Tajikistan. And many of them live in the area of the project. The most common are the Turkestan rat (*Rattus turkestanicus*), forest dormouse (*Dryomys nitedula*), grey hamster (*Cricetulus migratorius*), juniper vole (*Microtus juldaschi*), forest mouse (*Apodemus uralensis*), tolai hare (*Lepus tolai*), badger (*Meles meles*), red groundhog (*Marmota caudata*), porcupine (*Erethizon Dorsaum*), fox (*Vulpes vulpes*), wolf (*Canis lupus*), brown bear (*Ursus arctos*), and pine marten (*Martes martes*). The upper part of the ridge (outwith the project area) mountainous species such as Siberian ibex (*Capra sibirica*), and snow leopard (*Uncia uncia*) are known to be present.
303. There are eight bat species present in Tajikistan, and many of these will likely be present within the project area at times. Roosting opportunities exist within built structures and cliff/rock cavities, while an ample foraging resource is also present.
304. The rivers Surkhob and Vakhsh are home to 3-4 species of freshwater fish, of which rainbow trout is of particular importance.
305. The watercourses across the project site are very dynamic, with the steep overall gradient in the region resulting in high discharge levels and constant movement of substrate through the system. This reduces suitability for a wide range of aquatic flora and fauna, mainly as a result of very little aquatic plant life being able to survive in the relatively harsh conditions, and subsequently reducing opportunities for associated fauna. Overall this is reflected in the low numbers of fish present (3-4 species as likely being present). Regardless of this, the aquatic environment should be protected during construction and operation.

5.11.3 Species of Concern

306. There are seven rare and endangered plant species listed in the Red Book of the Republic of Tajikistan (2015 and 2017 editions) and protected by the state (list 1) that grow in the project area, albeit on the slopes of ridges, scree, in the

steppe or meadow zones, and generally outside the immediate project footprint. These species are as follows:

- *Cousinia corymbosa*
- *Alium Rosenbachianum*
- *Alium spititatinum*
- *Alium Suworovi*
- *Tulipa praestans*
- *Anemone bucharica*
- *Iris Haoliana*

307. Further to the above, there is also the potential for genetically valuable ancient fruit trees to be present across the project area. These include species such as pear (*Pyrus* spp.) and cherry (*Prunus* spp.).

5.11.4 Protected Areas (Formal / Informal)

308. No protected areas are situated within the Zol. The closest such example is the Romit State Nature Reserve, which lies c. 25km to the north-west of the Scheme. This area was previously recognised by IUCN as a major biodiversity site, but has lost this status due to the value of the Reserve having been compromised by unregulated grazing, wood gathering, and illegal hunting⁵⁴.

309. The next closest area is the Sari Khosor National Park, which lies c. 30 km to the south of the Scheme.

5.12 Cultural Heritage

310. The Academy of Sciences of the Republic of Tajikistan – Institute of History of Archaeology and Ethnography was contacted in June 2019, for information on the potential for cultural heritage locations to be present in the project area i. Their response stated that that “there are no historical and archaeological monuments in the area where the route is laid”.

311. Several assets of local community value (mosques, tea houses etc.) were identified during the community consultations, these assets are listed in Table 27.

312. A cemetery is present at km 70 +500, although the road alignment has been modified to avoid this location, as detailed in the alternatives paragraph 151.

5.13 Waste and Materials

313. The existing waste management provisions in the project area, and surrounding area, is generally limited to local municipal waste disposal sites. The Committee on Environmental Protection identified 69 disposal sites in 2016, and advised that the existing disposal sites at regional centres are overfilled⁵⁵. A summary of municipal waste sites is presented in Table 25.

Table 25: Municipal Waste Disposal Sites in the project area

	Number	Area (ha)
Total	69	280.49

⁵⁴ Ning, Wu; Rawat, GS; Joshi, S; Ismail, M; Sharma, E. 2013. High-altitude rangelands and their interfaces in the Hindu Kush Himalayas. Kathmandu: ICIMOD

⁵⁵ https://www.unece.org/fileadmin/DAM/env/epr/epr_studies/ECE.CEP.180.Eng.pdf

	Number	Area (ha)
Dushanbe	1	20.00
Towns and districts under republican subordination	12	37.66
Sughd Oblast	24	130.17
Khatlon Oblast	24	83.86
Gorno-Badakhshan Autonomous Oblast	8	8.80

Source: Committee for Environmental Protection, 2016

314. There are no waste disposal facilities for hazardous wastes present in the project area, and there is limited provision for the management of hazardous waste disposal in Tajikistan. The current focus is on the management of pesticides and radioactive waste²¹.

5.14 Socio-Economic, Health and Community Safety

5.14.1 Introduction

315. Project-specific data presented in this section has been collected in a number of ways including:

- Desktop research and review of publicly available data;
- Consultation with directly Affected People (APs);
- Detailed Measurement Survey (DMS) to measure the areas of the affected land, buildings and number and type of affected assets;
- Valuation of replacement cost of the Affected Assets to identify the cost of compensation needed for loss of assets, income and other livelihood sources and allowances;
- Census survey to identify the number of Affected Households (AHs);
- Socio-economic survey (SES) to identify the current socio-economic condition of APs as well as their perceptions of the impact of the Project on their livelihood; and
- Consultation with the local communities along the alignment affected by the Project.

316. The socio-economic data was primarily collected for the development of the Land Acquisition and Resettlement Plan (LARP) required for the Project. A detailed description of the methodology adopted for completion of the above tasks is provided in the separate LARP.

317. The SES and census survey in the Project area were conducted in September and October 2018. The SES included renters and informal users of affected lands and buildings, in addition to owners and renters of permanently and temporarily affected businesses.

318. The surveyed population lives in villages located along the Project road. At the time of preparation of this EIA, population living in villages in the vicinity and along the village access roads has not been surveyed as these were not part of the initial design. An Environmental and Social assessment of impacts to the areas and populations along village access roads, will be undertaken after the publication of this EIA in July 2019, and will be publicly disclosed.

5.14.2 Population and demography

319. The Project is located in two Districts, Rogun (Роғун) and Nurobod (Дарбанд) spread across 500 and 900 km² respectively. They form part of the Districts of Republican Subordination - DRS (Ноҳияҳои тобеи ҷумҳурӣ) a region in Tajikistan, consisting of 13 districts that are directly under central rule. The population count is 22,600 in Rogun and 66,000 in Nurobod⁵⁶ The largest city in the Project area is Roghun, the capital of Rogun province with an estimated 9,600 population as of 2007⁵⁷.
320. A total of 16,438 people live in the 17 Project-affected villages located along the Project alignment. In total, there are 8,413 males and 8,038 females living in 2,007 households. The average family size in these villages ranges from six persons in Bozorak and Darband to ten persons per household in Siyagulak, Tuhtor and Gulmon villages.
321. According to the 1994 Constitution, Tajik is the state language and Russian a language of international communication and dialogue. Tajik is the language most widely used, although Russian continues to be used, mainly in urban areas. Uzbek is the main language for approximately 25% of the population. Other languages spoken by respective minority groups are Kyrgyz, Tatar, Turkmen, Uighur and Korean⁵⁸. In the Project area, Tajik is the main language, and many people do not speak Russian, in particularly women in the remote mountainous areas.

5.14.3 Social Organisation & Kinship

322. The social organisation in the Project affected areas follows a very traditional, patriarchal and male dominated model. For the most part, men earn the household income, the majority of them employed in Russia or other neighbouring countries. Division of work is gender based, and women are expected to perform domestic chores as well as field labour..
323. When decision-making processes are considered, the SES study indicated that women are consulted and take part in the decision-making processes in all major family activities, with the exception of a small percentage of women who reside in the more remote traditional villages.
324. Almost all (96.71%) of the surveyed people live in extended families. The remainder of those surveyed (3.29%) live within nuclear families. The household size of the sampled households ranges from one to thirty persons in a household. A total of 27 of the surveyed households have up to five persons living in the household, 76 (50%) have 6-10 persons, 49 (32.24%) households have 11-20 persons and 4 (2.64%) households have 21-30 persons living in one household. Married heads of households account for 92.76% of all heads of household, 5.26% are widowed and the percentage of unmarried heads of household is marginal (1.32%).

⁵⁶ According to 2010 census.

⁵⁷ Population of the Republic of Tajikistan as of 1 January 2008, State Committee of Statistics, Dushanbe, 2008

⁵⁸ Khodjamurodov G, Rechel B. Tajikistan: Health system review. *Health Systems in Transition*, 2010, 12(2):1–154.

5.14.4 Gender, Ethnicity, Indigenous People

325. In Tajikistan, the sex ratio (men per 100 women) is 99⁵⁹, which is consistent with figures for the Project. However, in the surveyed HHs, the portion of male-headed households is 145 AHs (92.35%), while 12 (7.64%) of surveyed households are headed by a woman.

326. Ethnic groups present in Tajikistan are Tajik 84.3% (includes Pamiri and Yagnobi), Uzbek 13.8%, other 2% (includes Kyrgyz, Russian, Turkmen, Tatar, Arab)⁶⁰. All the surveyed Ahs in the Project area (157 households) identified as being Tajik

327. There are no indigenous people in the Project affected area.

5.14.5 Religion

328. Islam is the prevailing religion in Tajikistan with 98% Muslim population (Sunni 95%, Shia 3%) other 2%⁶¹. In the Project area, all surveyed persons identified as are Muslim. There is a Mosque in each village along the alignment.

5.14.6 Age Distribution

329. Tajikistan has a very young population. Only 3% of the population is over the age of 65 in Tajikistan, well below the average for developing countries in Europe and Central Asia (ECA) (15%).

330. The age distribution of the surveyed population for the project LARP (Table 26) shows that the 18-35 age group was the most represented (35.94%). The profile of the youth community is even more pronounced if the 0-7, 8-17 and 18-35 age groups are combined. Such a comparison shows that 88% of the surveyed population is younger than 35. The 36-45 age group accounts for 5.79% and the 46-55 age group accounts for 2.94 %. The 56-65 and 66 and above age groups account for 2.69% and 0.59%, respectively. The head of households are almost equally spread in three age groups; 18-35, 36-45 and 56-65.

Table 26: Age Distribution of Population

Age	Household members		Head of AHs	
	No	%	No	%
0 - 7	311	26.11		
8 - 17	309	25.94		
18 - 35	428	35.94	25	16.45
36 - 45	69	5.79	36	23.68
46 - 55	35	2.94	38	25.00
56 - 65	32	2.69	35	23.03
66 and more	7	0.59	18	11.84
Total	1,191	100	152	100

⁵⁹ 2018 est. according to CIA World Factbook

⁶⁰ 2014 est. according to CIA World Factbook

⁶¹ Ibid.

5.14.7 Infrastructure and Amenities

331. The Ministry of Water Resources and Land Reclamation is responsible for urban water supply and waste water. At present, water supply and sanitation facilities in Tajikistan are neither safe nor adequate. With an annual production of over 13 000 m³ of water per capita, Tajikistan is one of the most wealthy states in the world in terms of water supply (UNDP, 2003), ranking third in the world in terms of water resources per head (EIU, 2006), yet in 2000 the country was able to provide just 59% of its population with access to safe drinking-water. In DRS, only 55% of the population has access to piped water or public taps. Only a couple of villages in the Project area have piped water while the majority rely on spring water and purchased bottled water for daily usage, costing TJS 100-120 per month.
332. A majority of schools and rural medical institutions lack proper sanitation and water facilities. Where piped water is not available, water is mostly collected by women⁶².
333. Small rural hospitals with 25–75 beds offer basic nursing care and some medical and obstetric services. They are staffed by one doctor, the “*therapist*”. There were 153 rural hospitals in 2007. There were also 45 district hospitals reorganized from rural hospitals. These hospitals are in very poor condition and only active outside the autumn/winter season, with run-down buildings, unheated and without electricity in winter, few supplies or bedding, and very little diagnostic and therapeutic equipment. Most beds are unoccupied. All district, regional and national hospitals have ambulance services for emergency care, and there are also separate, specialized emergency hospitals. However, the ambulance fleet is old and incommensurate with requirements, and modern means of communication are lacking (Ministry of Health, 2005b)⁶³.
334. Most of the Project villages have a mosque and a chaihona (tea house) where village men gather. In some villages there are small shops and businesses along the central village road. Other services such as larger markets and administrative services are available only in Jamoat and Hukumat centres. Public transport along the Project alignment is intermittent and is based on independent operators/ taxi drivers using either small vans, minibuses or jeeps. There is no fixed schedule, and transport departs when full (from market places and other areas of congregation). There are no visible bus stations/ stops with amenities along the road.
335. Table 27 summarises facilities in the villages on the alignment
336. Electricity is available in all Project villages; however, energy supply is intermittent, especially in the summer period when water levels that feed water reservoirs used for production of electricity are low. Only a few villages have piped water while the majority rely on spring water and purchased bottled water for daily usage, costing TJS 100-120 per month.
337. Public transport along the Project alignment is intermittent and is based on independent operators/ taxi drivers using either small vans, minibuses or jeeps.

⁶² Khodjamurodov G, Rechel B. Tajikistan: Health system review. *Health Systems in Transition*, 2010, 12(2):1–154.

⁶³ Ibid.

There is no fixed schedule, and transport departs when full (from market places and other areas of congregation). There are no visible bus stations/ stops with amenities along the road.

Table 27: Facilities in Villages on the alignment

District /Hukumat	Subdistrict/ Jamoat	Villages along the Project road	School	Med. Station/ hospital	Mosque	Special place for praying/ worship	Cultural center/ chaihona
Rogun	Obi Garm	Bozorak	1		1		
		Kandak	2	1	2		1
	Sicharog	Shohi Aslon	1				1
Nurobod	Hakimi	Chavchii Poyon	1		1		1
		Sadokat			1		1
		Layron	1				1
		Siyagulak	1	1	1	Spring	1
	Muchiharfi	Chepak	1		1		1
		Muchiharfi Kalon	1	1	2	Holy place for praying	1
	Komsomolobod	Degai	2	1	2		2
		Tuhtor	1		1		1
		Tegermi	2	1	1		3
		Pandovchi	2	1	1		1
	Safedcheshma	Dehi Tag	1	1	2		2
		Ulfatobod	1	1	2		1
		Gulmon	1		1		
	Darband	7th microrayon					
Total			19	8	19	2	18

Source: Land Acquisition and Resettlement Plans Obigarm-Nurobod Road, December 2018

5.14.8 Health and Education

338. While the Government of Tajikistan remains the main provider of health care services, most health expenditure is covered through private out-of-pocket payments. In 2017, overall health spending was 2.3 percent of GDP. Tajikistan's population is facing a double burden of both noncommunicable and communicable diseases. Although the Ministry of Health and Social Protection of Tajikistan has reported that all demographic and health indicators such as maternal and child mortality, incidence of infectious diseases (tuberculosis, HIV/AIDS, malaria) and noncommunicable diseases (cardiovascular, oncological, endocrinological) are improving, infant and maternal mortality rates are among the highest in the World Health Organization European Region and malnutrition is a major public health concern (World Bank).

339. The Ministry of Health is responsible for national health policy, but has no control over the overall health budget, and directly manages only health facilities at the national level. Local authorities are responsible for most social services, including health and education.

340. There are 19 schools in villages on the alignment and 8 Medical Centres.

341. Physical barriers play an important role in remote mountainous regions, where road conditions are poor, means of transport limited and many communities cut off for months during the winter season.

342. While the Government of Tajikistan remains the main provider of health care services, most health expenditure is covered through private out-of-pocket payments. In 2017, overall health spending was 2.3 percent of GDP. There is an estimated 1.7 physicians/1,000 population (2014) and 4.8 beds/1,000 population (2013)⁶⁴.
343. Tajikistan's population is facing a double burden of both noncommunicable and communicable diseases. The risk of major infectious diseases is high. Poor water quality, a result of lack of maintenance of the water supply system, and insufficient health education and health promotion among the population are mainly responsible for periodic outbreaks of infectious diseases. Prevalent food or waterborne diseases are bacterial diarrhoea, hepatitis A, and typhoid fever and malaria is present in areas below 2,000 m asl. In 2007, the morbidity rate for malaria was 9.5 cases per 100 000 population (Matthys et al., 2008; WHO Regional Office for Europe, 2010).
344. Infant and maternal mortality rates are among the highest in the World Health Organization European Region and malnutrition is a major public health concern (World Bank).
345. Acute respiratory infections, diarrhoea and prenatal conditions are the main registered causes of infant mortality. Most of the infant deaths (71%) occurring the first week of life. The infant mortality rate is 30.8 deaths/1,000 live births (male: 34.8 deaths/1,000 live births and female: 26.5 deaths/1,000 live births)⁶⁵.
346. Maternal health remains another major challenge. According to official data, maternal mortality has decreased by more than half from its peak at 124.4 per 100 000 births in 1993 to 43.4 in 2006 (WHO Regional Office for Europe, 2010). It is likely that these figures underreport actual maternal mortality, as there are a large number of home deliveries. It has been estimated that, in 1995, the actual maternal mortality rate was 123 per 100 000 live births (Hill et al., 2001) rather than the officially recorded 97.7 (WHO Regional Office for Europe, 2010).
347. According to UNICEF, maternal mortality in Tajikistan can be attributed to poor antenatal care, inadequate health services during delivery, and transportation problems, particularly in rural areas (Guerra et al., 2003).
348. There are 15,000 people living with HIV/AIDS and the HIV/AIDS adult prevalence rate is 0.3 %.⁶⁶ Intravenous drug use is assumed to be the major source of HIV transmission. Other groups at particular risk of HIV/AIDS include the large number of labour migrants and the growing number of commercial sex workers. There are an estimated 8000 commercial sex workers in the country.⁶⁷
349. Tuberculosis re-emerged as a major public health threat during the 1990s. According to Ministry of Health data, the incidence rate skyrocketed between 1993 and 2007, increasing from 11.7 to 94.3 per 100 000 population (WHO Regional Office for Europe, 2010).

⁶⁴ CIA World Factbook

⁶⁵ 2018 est. according to CIA World Factbook

⁶⁶ 2017 est. according to CIA World Factbook

⁶⁷ Khodjamurodov G, Rechel B. Tajikistan: Health system review. *Health Systems in Transition*, 2010, 12(2):1–154.

350. Since independence, the prevalence of diseases caused by micronutrient deficiencies (iron-deficient anaemia, iodine-deficiency disorders, vitamin A deficiency) has increased, as a result of deteriorating access to high-quality food and iodized salt, especially for vulnerable groups of the population. Poor intake of food, an unbalanced diet rich in animal fats and high infection rates (with resulting diarrhoea), particularly during the summer, are major causes of malnutrition. Poor nutrition is the result of the lack of food in some households particularly in rural and mountainous areas, and poor feeding practices for infants and young children⁶⁸.
351. Project-specific health data was not compiled for this EIA and the information presented above is a result of desk-based research of publicly available data sources. Further health data will be collected during the Community, Social and Health Review, and used to inform ongoing activities in the Social Risk Register.
352. Education expenditure amounts to 5.2% of GDP, and overall literacy⁶⁹ is 99.8% (male: 99.8%, female: 99.7%)⁷⁰.
353. Expected years of schooling in Tajikistan is less than in regional countries and below the Europe and Central Asia average (10.8 in Tajikistan versus 12.6 in Kyrgyzstan or 13.3 in Kazakhstan and 12.4 Europe and Central Asia average⁷¹). The indicator's value reflects low preprimary enrolment rate (12.4 percent for 3–6-year-olds in 2016) and 9 years of mandatory education in school with high dropout rate after grade 9, especially for girls (World Bank).
354. The expected years of schooling in Tajikistan is below the Europe and Central Asia average (10.8 in Tajikistan versus 12.6 in Kyrgyzstan or 13.3 in Kazakhstan and 12.4 Europe and Central Asia average⁷²). The indicator's value reflects low pre-primary enrolment rate (12.4 percent for 3–6-year-olds in 2016) and 9 years of mandatory education in school with high dropout rate after grade 9, especially for girls (World Bank).
355. Generally, the Project population is well educated, and the LARP surveys reveal a high level of literacy of heads of household with 66.45% having completed secondary education. A further 12.50% and 21.05%, respectively, obtained a college or university degree. Generally, the educational profile of other family members is lower in all educational categories than among the heads of households. There were no illiterate people in the surveyed sample. Educational levels are summarised in Table 28.

Table 28: Education of Surveyed Population

Education status	Head of the household		Other household members	
	Number	%	Number	%
Illiterate	0	0	0	0
Primary school	0	0.00	149	12.51
Secondary education	101	66.45	681	57.18

⁶⁸ Ibid.

⁶⁹ Age 15 and over can read and write.

⁷⁰ 2015 est. according to CIA World Factbook

⁷¹ Excluding high-income countries such as France, United Kingdom, and Finland.

⁷² Excluding high-income countries such as France, United Kingdom, and Finland.

Technical/other college	19	12.50	23	1.93
University degree	32	21.05	61	5.12
School age children	0	0.00	277	23.26
Total	152	100	1191	100

Source: Land Acquisition and Resettlement Plans Obigarm-Nurobod Road, December 2018

5.14.9 Employment and Livelihoods

356. The economy in Tajikistan is dominated by minerals extraction, metals processing, agriculture, and reliance on remittances from citizens working abroad. Mineral resources include silver, gold, uranium, antimony, tungsten, and coal. Industry consists mainly of small obsolete factories in food processing and light industry, substantial hydropower facilities, and a large aluminium plant - currently operating well below its capacity. The GDP in 2017 amounted to \$7.144 billion. GDP composition, by sector of origin is agriculture: 28.6%, industry: 25.5% and services: 45.9%⁷³.
357. The 1992-97 civil war severely damaged an already weak economic infrastructure and caused a sharp decline in industrial and agricultural production. Less than 7% of the land area is arable and cotton is the predominant crop; Tajikistan imports approximately 70% of its food. Other significant agricultural products include grain, fruits, grapes, vegetables, cattle, sheep, goats.
358. Because of a lack of employment opportunities in Tajikistan, more than one million Tajik citizens work abroad - roughly 90% in Russia - supporting families back home through remittances that in 2017 were equivalent to nearly 35% of GDP⁷⁴.
359. The major economic activities in the Project villages are agriculture and animal husbandry. Wheat is the major crop in the area. Almost every household that has some land and livestock. Animals raised in the area include cattle, sheep, goats and horses. This is consistent with World Bank data which reports that agriculture accounts for more than 45% of the employment in Tajikistan. Agriculture as a source of income was reported by 18 AHs.
360. The LARP derived data on income sources shows that 38.8% of the surveyed households have income earned from labour. Out 152 AHs, 90 AHs (59.2%) receives remittance from household members working mostly abroad, in Russia and other former Soviet countries. The sum they receive surpass all other sources of income. Business (self-employment) provides the highest average income per household (TJS 2,062.50/month) followed by remittance and paid labour.
361. Most of the households' income is concentrated in the three lowest categories: 300-1,000 TJS (11.92%), 1,100-2,000 TJS (54.97%) and 2,100-3,000 (21.85%) per month. The average monthly expenditure for the surveyed households is 1,696 TJS, with the largest portion (54.45%) spent on food.
362. Tajikistan has achieved a substantial reduction in its poverty rate since 2012. According to the national poverty line, the poverty rate fell from over 37% in

⁷³ 2017 est. according to CIA World Factbook

⁷⁴ CIA World Factbook

2012 to 29.5% in 2017. Rural poverty fell significantly from 36.1% in 2014 to 33.1% in 2017 across Tajikistan. The poverty rate in DRS is 37.3%⁷⁵.

363. Tajikistan's average household size and dependency ratio are 6.43 members and 56%, respectively. With a high birth rate (3.82 births per woman) and a relatively low life expectancy (69.7 years at birth), the high dependency ratio is mostly driven by large numbers of children. Only 3% of the population is over the age of 65 in Tajikistan, well below the average for developing countries in Europe and Central Asia (ECA) (15%). There is a relationship between poverty status and household size. Poor households have, on average, 7.95 members and a dependency ratio of 62%, while nonpoor households have an average of 5.9 members and a dependency ratio of 53%.

364. In the Project area, women are underrepresented in the workforce. Overall, there are 70 registered female entrepreneurs in seven Project Jamoats. Out of these, 25.71% (18) are tailors working mostly from home. Others sell goods at the local bazaars and some in their kiosks/small shops. Sicharog Jamoat does not have any registered female entrepreneurs. The data obtained from the Jamoats is presented in Table 29⁷⁶

Table 29: Women-Entrepreneurs in Project Jamoats

Jamoat	No of women entrepreneurs	Type of business	Other remarks
Obigarm	5	One guesthouse owner/ manager, one tailor, three women sell toys and clothing for women at the bazaar.	Women travel to Dushanbe, purchase underwear and other clothing for women and resell in Obi Garm.
Sicharog	0		The village is located high-up on the mountains and there is no work for villagers. In addition, traditional and religious values prevent women from seeking employment.
Hakimi	4	Selling female underwear and groceries	
Komsomolobod	35	Work at a bazaar, selling handcrafts	Komsomolobod was an administrative and business center of Nurobod.
Safedchashma	6	Two have small shops and four are tailors. One of the women makes traditional ornaments for bed linen, pillows and other dowry items.	Tailors usually work from homes and do tailoring work by order.
Mujiharf	6	Tailors	Women work in their home as tradition and religious values restrict them from

⁷⁵ 2017, World Bank

⁷⁶ Data from the Social and Gender Impact Assessment prepared by ADB in October 2018 for the project.

Jamoat	No of women entrepreneurs	Type of business	Other remarks
			working outside their homes.
Darband	14	Seven are tailors and seven run small shops	In Darband, women have a workshop where they work.
Total	70		

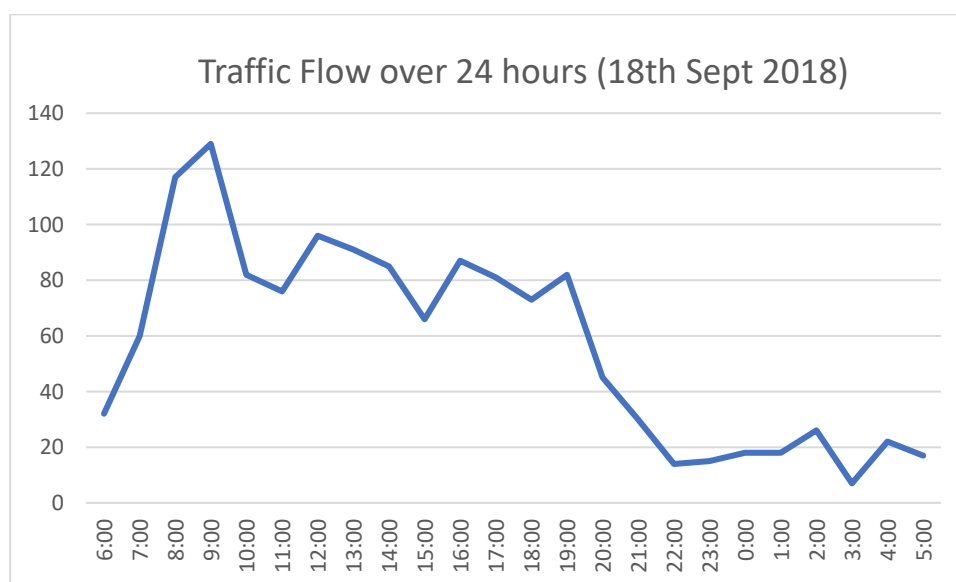
365. Total youth unemployment⁷⁷ in Tajikistan is 16.7% (male: 19.2%, female: 13.7%)⁷⁸. Project-specific youth unemployment was not compiled for this EIA.

5.14.10 Transportation/traffic – Current and future traffic projections

366. There are a few motorised and non-motorised vehicles using the proposed alignment. Site inspections in August 2018 revealed that the alignment was used by agricultural vehicles collecting harvested hillside grass, for use as winter animal feed (fodder) and foot traffic and donkey carts between villages. Traffic counts on the existing M41 were carried out in September 2018.

367. Classified traffic counts were undertaken on the M41 road at the village of Hakimi, approximately 10km south of Nurobod and the results are presented in Figure 34. From the origin and destination (OD) survey results it was clear that substantially all traffic observed at this point would have to divert if the bypass (new alignment) did not go ahead. Traffic at Hakimi also represented substantially all through traffic that would use the proposed bypass. Counts were undertaken from Tuesday 18th to Saturday 22nd September 2018 inclusive. 24-hour counts were undertaken on the 18th and 22nd; 12 hour counts (from 06h00 to 18h00) on the other three days.

Figure 34: Traffic Flow over a 24 hour period (18th Sept 2018)



368. 12 to 24 hour expansion factors were derived from the two 24 hour counts and applied to the 12h counts (they differed very little: the expansion factors for all vehicles were 1.37 and 1.38 on Tuesday and Saturday respectively). There was

⁷⁷ Youth ages 15 to 24.

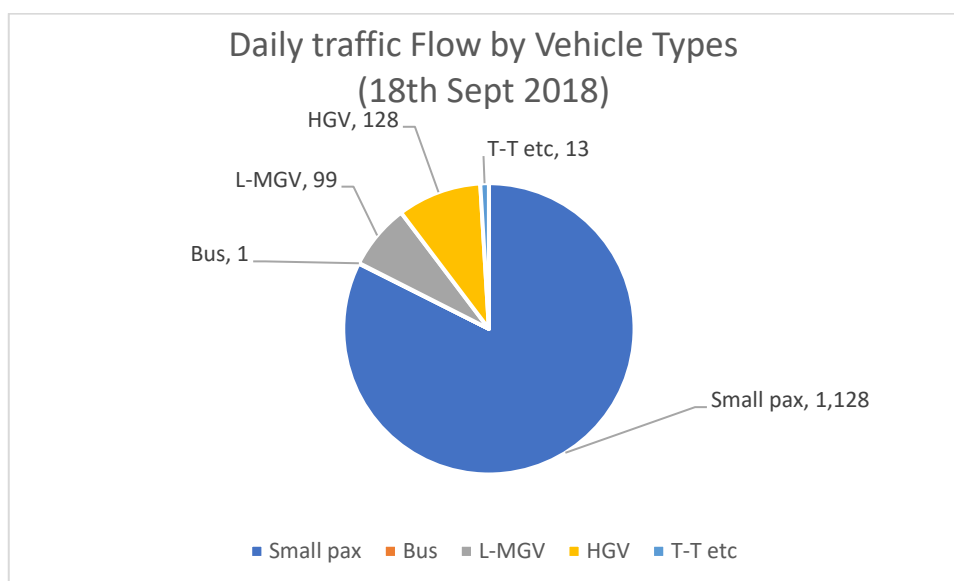
⁷⁸ 2009 est. according to CIA World Factbook

no systematic difference between weekday and weekend traffic and a simple average was taken as representative of base year traffic. (Note that only one bus was observed during the counts. It has therefore been omitted as a separate vehicle class).

369. Small passenger vehicles account for 84% of observed traffic at Hakimi. Assuming the Karamyk border crossing remains closed (it was closed in 2012), future growth is expected to be closely related to growth in GDP per head.

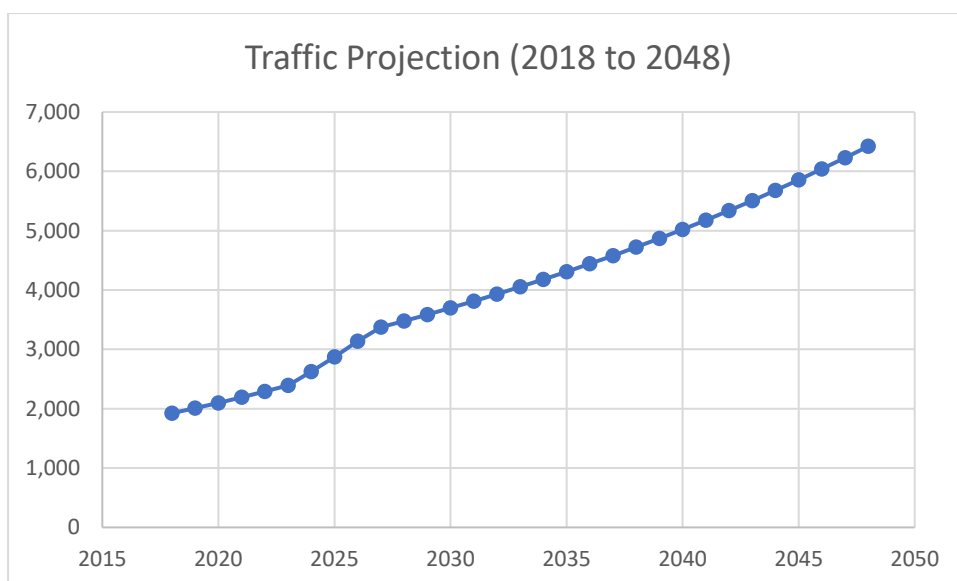
370. The breakdown of the daily flow by vehicle type is presented in Figure 35.

Figure 35: Daily flow by vehicle types (September 2018)



371. Historic growth of GDP per head from 2008 to 2017 was 4.3%; ADB forecasts are for 3.3% in 2018 and 5.4% in 2019. Forecast normal passenger and light-medium goods traffic has therefore been assumed to grow at 4.3% per year from 2019 to 2026, thereafter falling to 3%. Heavy goods traffic growth is expected to be closely related to GDP growth. Annual GDP growth for 2008 to 2017 was 6.6%; ADB forecasts for 2018 and 2019 are 6.0% and 6.5%. For forecasting purposes 6.2% is adopted, falling to 4.3% from 2027 (See Figure 36).

Figure 36: Traffic Growth Projection (2018 to 2048)



5.14.11 Road Safety

372. According to WHO data⁷⁹, reported road traffic fatalities in 2016 amounted to 427, of which 72% males and 28% females. The estimated mortality rate per 100 000 population was 18.1. Most deaths (40%) accounted for pedestrians, followed by vehicle passengers (36%). The average road traffic fatalities are 1 577.

373. In total, traffic incidents are estimated to cost the country around 4.4% of its annual GDP and result in total losses to the economy of around \$250 million annually⁸⁰. However, trends in road traffic deaths have slowly been declining in the past 9 years.

⁷⁹ Global status report on road safety 2018. Geneva: World Health Organization; 2018. Licence: CC BYNC-SA 3.0 IGO

⁸⁰ Presentation of the Ministry of Transport at the Regional Meeting on Renewing Regional Road Safety Goals and Targets for Asia and the Pacific and the Third Traffic Safety Grand Conference held in July 2016 in Seoul



Source: Department of the State Automobile Inspection, Ministry of Internal Affairs.

Figure 37: Trends in Reported Road Traffic Deaths

5.15 Project impact/influence area and Construction Footprint

5.15.1 Zone of Influence

374. The impact assessment considers a zone of influence surrounding the project, beyond which significant effects are considered unlikely to occur.

5.15.2 Factors influencing the zone of influence

375. **Materials and Waste:** The bulk earthworks carried out during the Soviet era and the availability of material from further slope excavations and rock from tunnel excavations means that there is likely to be a relatively small need for the development of off-site borrow areas. However, for the quantities of spoil produced there will be a need for the development of temporary and permanent off-site disposal areas.

376. **Water Quality:** Site observations suggest that Villages are generally developed downhill from the alignment so silty runoff from the construction works could enter streams used for washing and other purposes. It was noted during field visits that villages generally source water from locations uphill from the alignment⁸¹. Therefore access to potable water could be adversely impacted, but this risk will be mitigated to ensure uninterrupted supply.

377. **Access Roads / Routes:** Existing access roads will be upgraded to provide village access to the new alignment. Construction phase access routes will be used by the Contractor to bring plant and materials to the alignment from the existing M41 road, these construction access routes would be upgraded by the Contractor, where required, to ensure they are suitable for construction traffic, prior to the commencement of construction. In some cases, these may utilize the same routings at different phases of the project. The configuration of access roads / routes is still to be finalised.

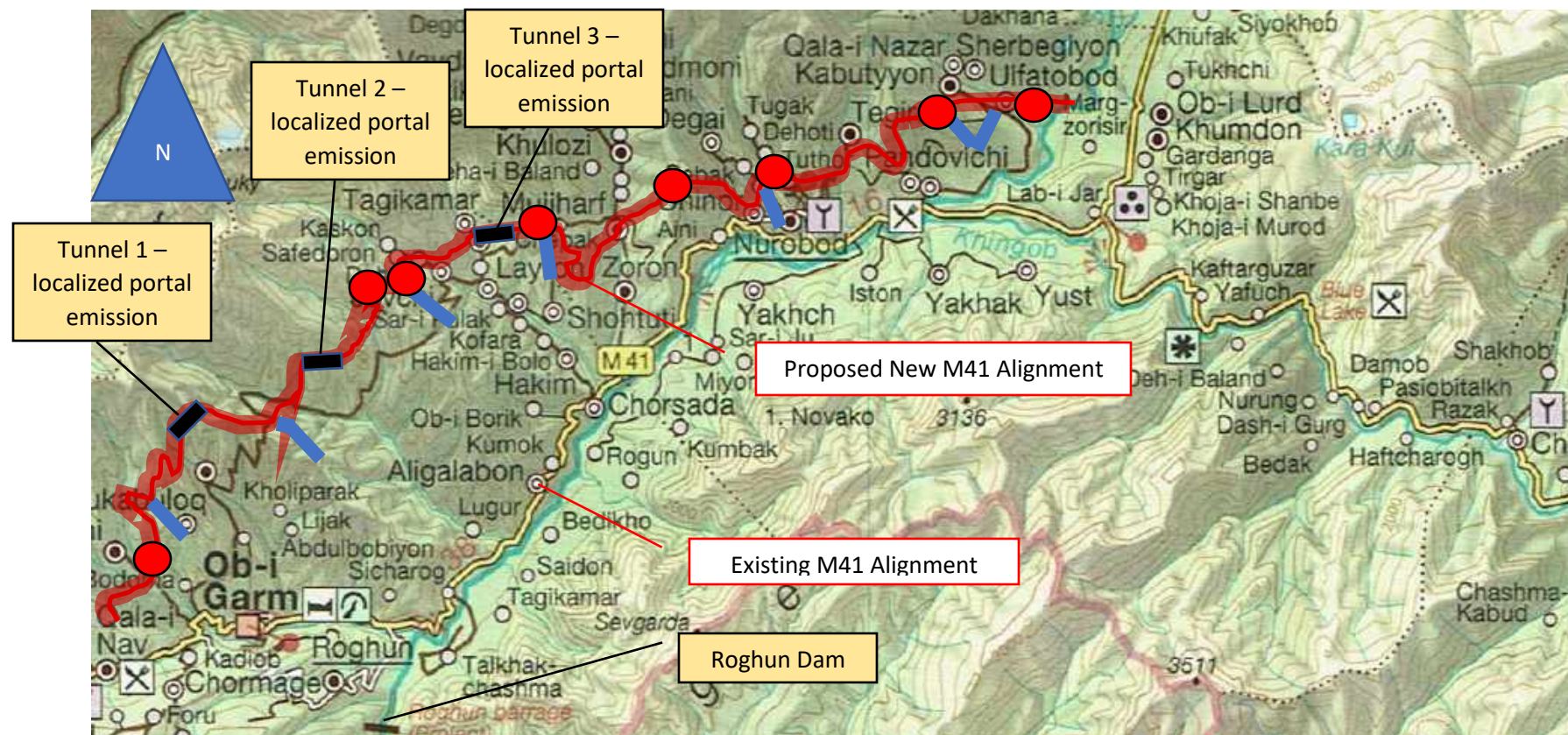
⁸¹ The village residents use narrow gauge plastic pipes (e.g. hose pipe) to bring water from the uphill locations to individual houses. The arrangement seems to be informal carried out by each household for their sole benefit. These pipes will need to be maintained and reprovisioned during the construction phase. This should include relocation of the pipes, where appropriate, to minimize the needs to local population to cross the alignment to fetch water.

5.15.3 Zone of Influence

378. Figure 38 shows a zone of influence for the project based on:

- A construction and operation corridor of 60m from the centre line of the road to indicate how construction noise, construction dust and traffic noise may influence the surrounding environment. This is based on an analysis of likely equipment use, in the construction phase and traffic movements in the operation phase. Initial modelling exercise suggest that traffic noise impacts will occur within a “zone of influence approximately 60m either side of the road centreline”.
- Watercourses that could transport silty runoff, domestic (sewage) waste or oily waste to areas remote from the alignment (downstream only).
- Areas where there is residential development i.e. concentrations of population susceptible to construction and operation impact from the alignment.
- At tunnels there will be localized portal emissions. During construction, noise will be limited to the initial development of the portal. Once developed noise will be contained within the tunnel. Outlets for the dust extract fans can create localized air pollution, though there are no residential / sensitive areas close to the six tunnel portals. During the operation phase the tunnel ventilation system and vehicle movements will transfer the vehicle emission pollutants to the tunnel portals. There are no sensitive receptors close to the portals.

Figure 38: Project Zone of influence



Key

	Road alignment
	Zone of influence from construction and operational phase traffic movements (60m)
	Watercourses downstream from alignment (400m indicated)
	Centres of population on alignment (mainly in north / south trending river valleys)

Source: Southern Tajikistan – Tourist Map, Gecko Maps. www.geckomaps.com Prepared for this EIA document

6 Consultation and Information Disclosure

6.1 Stakeholder Identification and Engagement

379. The census identified 157 Project-affected households, with a total of 1,395 household members. Detailed information on different categories of affected households (AHs) and displaced persons (DPs) by impact type, is provided in the impacts section of the LARP⁸². A summary of impacts is presented in Table E-2 of the LARP.

380. In total, 157 households (1,395 DPs) will be affected as follows:

- 87 residential land plots
- 3 commercial land plots
- 14 agricultural land plots
- 3,974 fruit trees, 1,925 fruit saplings and 6 pine trees and 6,372 other decorative trees
- 12 residential buildings (including 1 used as a cow shed)
- 77 ancillary residential structures
- 5 main non-residential buildings and 2 ancillary structures
- 136 AHs will lose 14 gates, 13 sheds, 1 basement 7 concrete/ clay outer walls and different types of fences and land improvements
- 4 operating businesses
- 3 petrol station workers will lose their employment as a result of the Project
- 17,057 m² of Dekhan farm land

381. In addition, 55,584 m² of jamoat' land, narrow strips of land, 2 fences and one advertisement board belonging to the communities/ local government, will be affected.

6.2 Consultations Undertaken

382. The Transaction Technical Assistance (TRTA) Consultant and the Project Implementation Unit for Road Rehabilitation (PIURR) conducted six consultations along the alignment (locations see Figure 39) with the AHs and wider communities, seven consultations in Hukumat and Jamoat authorities, and four female focus groups discussion. In total, 19% of the total affected population (163 of 857 persons (131 men and 32 women)) participated in the consultations conducted in September and November 2018. Participants received information about the Project, LARP processes, bidding process and expected time for the beginning of the works, as well as the Project Information Brochure detailing the Project-specific entitlements, government decree on the cut-off date, MoT letter on the establishment of the GRM and details on the GRM procedure. Participants were supportive of the project and shared their concerns and suggestions on issues such as road safety, the need for animal underpasses and adequate compensation, among other issues. A summary of the outcomes of the consultations are presented in Annex 5 of this EIA - Community Consultations and summarised in Table 30.

⁸² Chapter 2 of the project LARP

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Table 30: Summary of the 2018 consultations – places, participants and concerns

#	Date	Rayon	Jamoat	Villages	Attending		Discussion	
					M	F	Question	Response
1	30/ 08/18	Rogun	Obigarm	Kandak, Bozorak, Labijar, Sh. Aslon and Dehi Alisho	26	1	1) When will construction start 2) Water pipes on the alignment 3) Compensation for businesses	1) Q1 2019 2) Utilities will be relocated 3) New location, buildings and structures compensated.
1.1(f)	31/08/18	Rogun	Obigarm	Kandak	-	8	1) Water pipes on the alignment 2) Compensation for empty homes 3) How will cows cross the road 4) How will children cross the road	1) Utilities will be relocated 2) Replacement cost 3) No underpasses planned. We will recommend animal crossings 4) There will be a footpath, pedestrian crossing and speed bumps
2	1/09/18	Nurobod	Hakimi	Javchi Poyon	14	-	1) What will you look at during visit 2) When will construction start 3) We are looking forward to the road we think all will be better when it is completed 4) I am old, and I hope I will live long enough to see that road completed and to travel comfortably.	1) To give you information, methodology for compensation and answer questions 2) When studies are completed (Gender & Environmental) 3) n/a 4) n/a
2.1(f)	1/09/18	Nurobod	Hakimi	Yavchi Poyon and Siyagulak	-	6	1) I walked 7km to attend, where should I go? 2) May my husband phone from Russia to explain to him?	1) We will visit your house tomorrow. Compensation will be on replacement cost 2) Yes, no problem.

#	Date	Rayon	Jamoat	Villages	Attending		Discussion	
					M	F	Question	Response
							3) My husband is also in Russia. When compensation is paid should he come back? 4) We grow fruit in the village but have few visitors and they pay very little. We have honey but we rarely sell as there isn't enough for us.	3) This is not absolutely necessary. He may give authorization to collect compensation on his behalf 4) n/a
3	3/09/18	Nurobod	Mujiharf	Mujiharfi Kalon	22	1	1) When will construction start 2) What happens if something gets damaged during construction? 3) What should we do if the contractor deposits soil on our property 4) If we have a complaint about the Contractor who do we complain to?	1) Q1 2019 2) If property is damaged compensation is based on replacement value 3) The contractor will have to arrange and agree with local authorities about disposal spots. They will not be allowed to dispose without agreement of authorities and land owner. 4) There will be a GRC established at the Jamoat level when you can lodge complaints. There will also be a construction supervision company who can address complaints
3.1(f)	3/09/18	Nurobod	Mujiharf	Mujiharfi Kalon and Chepak	-	8	1) We are very happy that you came. We do not believe that the road will be constructed. We have been hearing about that road for years!	1) The road will be constructed. We expect construction to start in the first quarter of 2019. 2) The Jamoat will replace your land. The valuator will calculate

#	Date	Rayon	Jamoat	Villages	Attending		Discussion	
					M	F	Question	Response
							<p>2) You are acquiring my son's house. He will not have enough land to make a new house. When you pay compensation, will he be able to purchase an apartment in Dushanbe.</p> <p>3) There will be a lot of dust during the construction. You can see we have so much dust even without construction.</p> <p>4) If the contractor does not sprinkle water, what should we do? We saw on some other project how much dust they make</p>	<p>a replacement cost for a new house and other structures and assets affected. However, I am not sure if for the compensation amount your son could purchase an apartment in Dushanbe.</p> <p>3) The Contractor will be obliged to take positive action (sprinkle water) during the construction and thus, minimise the effects of dust.</p> <p>4) You'll have a GRC established at the Jamoat level and you can lodge your complaint there with your Rais or any other designated grievance redress committee member. In addition, there will be a construction supervision company and you may complain to the site engineer</p>
4	4/09/18	Nurobod	Komsomolobod	Deagi, Tuhtor, Bulbuldara, Tegermi and Pandovchi	16	-	<p>1) There were people before you. They came, asked the same questions and measured our properties.</p> <p>2) Some people that are affected are not on your list and some people who are on</p>	<p>1) Yes, you had a resettlement specialist from the design company. They made a general list of displaced persons and their assets. This team will measure exactly everything that is going to be affected by the project. You will be with us</p>

#	Date	Rayon	Jamoat	Villages	Attending		Discussion	
					M	F	Question	Response
							<p>your list, do not live in our village</p> <p>3) Will everything that is affected, be paid for?</p> <p>4) If we have a complaint should we go to the Raisi Jamoata?</p>	<p>when we measure affected land, structures, count affected trees, etc. A valuation will be done and compensation calculated based on our inventory of losses</p> <p>2) We have a topographer with us and we will determine what is going to be affected. Affected assets of those DPs who are not on the list will be documented and the DPs will be added to the list of displaced persons.</p> <p>3) Yes, except unauthorised use of land. However, any structure, land improvement or fruit trees on such land, will be compensated</p> <p>4) There will be a grievance redress committee at the Jamoat level and Raisi Jamoata, as well as Raisi Mahale. You may lodge your complaint to the GRC focal person or any other GRC member.</p>
5	6/09/18	Nurobod	Safedcheshma	Tag	20	-	1) During the SES and the DMS, who will be present?	1) Social safeguards specialists, Raisi Mahale and the Jamoat's representatives will be present.

#	Date	Rayon	Jamoat	Villages	Attending		Discussion	
					M	F	Question	Response
							2) How will you pay for the fruit trees? 3) If the water pipes are affected during the construction, who will pay for the damages?	2) All affected fruit trees will be compensated. Compensation will reflect income replacement. 3) All these amenities will be relocated where necessary. The contractor will repair any damage resulting from the construction activities.
6	30/10/ 19	Nurobod	Daraband	7 th Microrayon	17	-	1) When will the road construction start? 2) When will you pay us for our affected assets? 3) Will there be some opportunities for women to work as cooks, bread bakers, cleaners etc during the road construction?	1) We expect the works start around mid of 2019. 2) All compensation will be paid before the Contractor starts the works. 3) Yes. We will inform you about positions which will be needed by the Contractor
6.1(f)	30/10/18	Nurobod	Daraband	7 th Microrayon	-	7	1) When will the road construction start 2) Will there be some opportunities for women to work as cooks, bread bakers, cleaners etc during the road construction?	1) We expect the works start around mid of 2019. 2) Yes. We will inform you about positions which will be needed by the Contractor

6.3 Information Disclosure

383. After Government and IFI approvals, the implementation-ready LARPs for Construction Packages 1 and 2 will be uploaded to the relevant IFI and MoT websites. As mentioned in Section 1.2 of this EIA, the Project road is divided into three packages. Separate LARPs have been created for Package 1 by ADB/OFID, and for Package 2 by EBRD. No land acquisition or resettlement is expected for Package 3 of the Project, which is funded by AIIB.

6.4 Process for Consultation During Implementation

384. A Stakeholder Engagement Plan (SEP) has been prepared as a standalone document for the MoT to identify key stakeholders and define communication channels and plans regarding the Project. It provides an overview of relevant national legislation, the ADB Safeguards Policy Statement requirements, the EBRD ESP 2014, AIIB's Environmental and Social Framework, European Union (EU) directives and international best practice related to information disclosure and outlines the general approach to stakeholder engagement and public consultation.

385. The SEP is a live document that will be reviewed and updated periodically and in line with new activities, changes in Project design and newly identified stakeholders. The SEP summarises the methods, procedures, policies and activities that will be implemented by the PIURR to inform stakeholders in an inclusive and timely manner about the potential impacts of the Project. The public will be able to access and review this SEP at designated locations.

6.5 Grievance Redress Mechanism

6.5.1 Overview

386. The scope of the Grievance Redress Mechanism (GRM) is to address issues related to involuntary resettlement, social and environmental performance, and information disclosure. AH will have the right to file complaints and/or queries on any aspect of the Project, including land acquisition and resettlement, and appeal any decision, practice or activity related to the Project. The PIURR will ensure that grievances and complaints about any aspect of the project are acknowledged and addressed in a timely and effective manner.

387. The Grievance Redress Committees (GRC) have been established at the Jamoat/village level in 17 of each project villages, by requirement of MoT Letter No. 872, issued on 27 August 2018, and will function for the duration of the project's implementation. There were 17 GRCs formed. A Focal Person (FP) was appointed at each village and at the MoT PIURR. The PIURR FP participated in all consultations with communities (held in September 2018) and shared contact details with participants for questions related to the Project and in the event of grievances for the entire duration of the Project, including the preparation and implementation of the LARP. All efforts will be made to settle issues at the Project level.

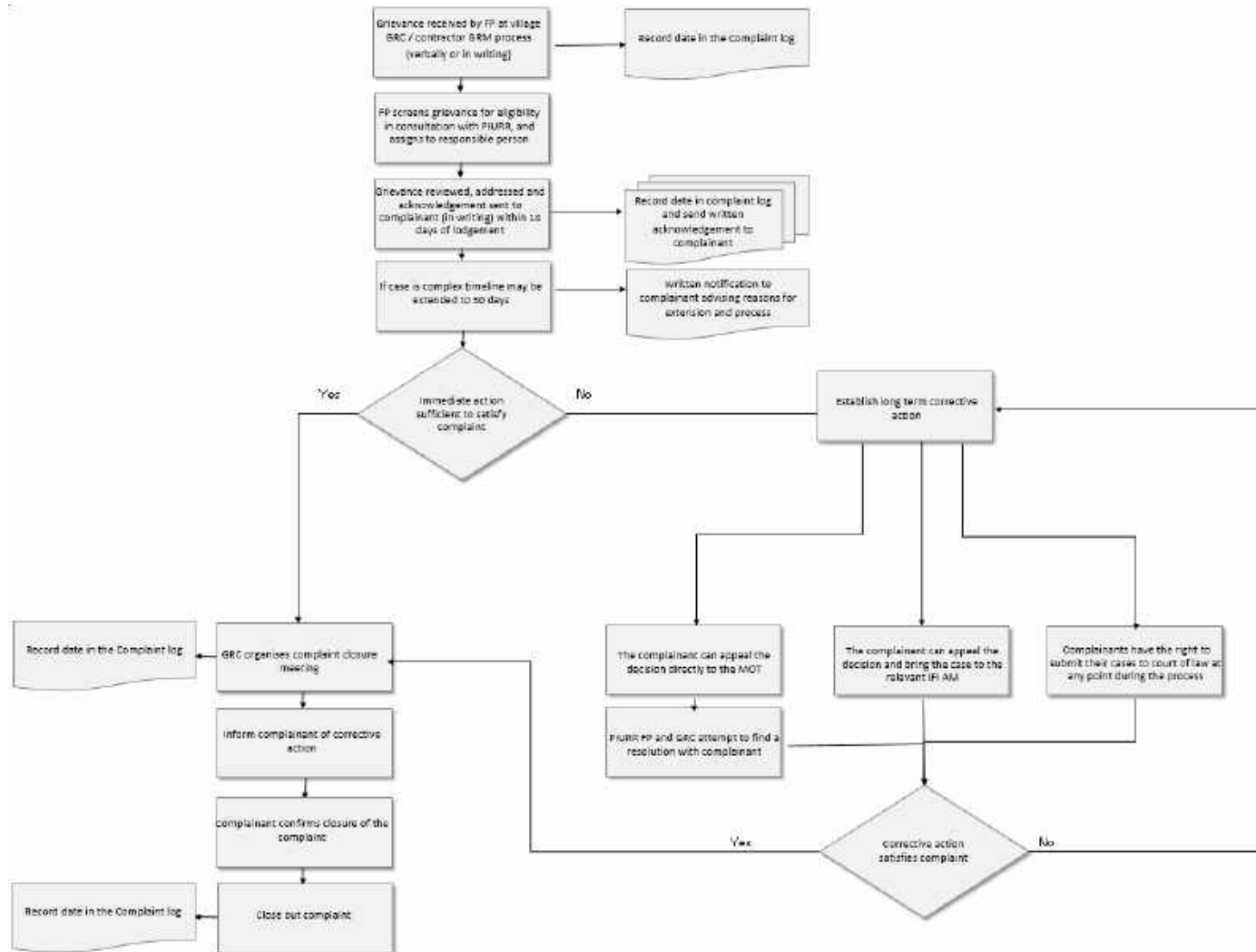
388. When and where the need arises, this mechanism will be used for addressing any complaints that may arise during the implementation of project. The grievance mechanism is scaled to the risks and adverse impacts of the project. It addresses affected people's concerns and complaints promptly, using an understandable and

transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people at no cost and without retribution. The mechanism does not impede access to Tajikistan judicial or administrative remedies. MoT will appropriately inform the affected people about the mechanism before start of commencement of any civil works.

6.5.2 Grievance Focal Points, Complaints Reporting, Recording and Monitoring

389. The process in the form of a flowchart is shown in Figure 40

Figure 40: Grievance Redress Mechanism Process



390. The following are the procedural steps to file a complaint, pose an inquiry on matters relating to project implementation, environmental concerns and other issues regarding the Project.
391. It should be noted that multiple methods for raising grievances are highlighted below, and all grievances will be addressed in the same way via a process that is consistent across the Project alignment. The option to submit grievances anonymously should be available to complainants using the public grievance form.
392. The person affected by the Project should raise their suggestions / concerns / complaints via one of the GRMs available, at the first phase an attempt will be made to resolve complaints via the regional level grievance mechanism with the initial complaint lodged with the FP at the village GRC. The FP receives the grievance, while the FP and MoT PIURR representatives screen for eligibility. If eligible, the FP organises a meeting of the GRC.
393. The complaint should be reviewed, acknowledged, recorded on the complaints log and a decision made on the relevancy of the complaint within 14 days of initial lodgement (unless the case is complex, in which case the review period may be extended to 30 days). Full details can be found in the SEP.
394. If a DP is not satisfied with MoT's decision even after GRC review of the grievance, then s/he can lodge the grievance to the Tajikistan legal system for registration, revision and resolving the case. All efforts will be made to resolve grievances at the village/Project level through community consultation with the complainant. If this is not possible, attempts will be made to resolve the grievance at the PIURR level to avoid/minimise litigation. In addition, the complainant can appeal the decision and bring the case to the IFI's Accountability Mechanism (AM). The GRM at the Project level does not in any way impede the DPs' access to the IFI's AMs. If DPs want to register a complaint, the PIURR Focal Person will provide the complainants with the relevant contact information for each section.
395. Complaints may also be made directly to the contractor, using the contractors GRM process:
396. There is one woman and one DPs representative in each GRC.
397. All complaints regardless of the outcome and solutions will be properly documented by the MoT PIURR within the GRC Complaints Register, and made available to IFIs for periodic review, monitoring and evaluation purposes in line with the SEP.

7 Assessment of Impacts

7.1 Assessment Process

398. This chapter sets out approach to impact assessment and mitigation that can be easily understood by design engineers, construction contractors and implementing agencies.

399. The EIA document is designed to serve the objectives of a number of stakeholders, including:

- The public – including directly or indirectly affected individuals on the alignment, individuals and groups with interests for the population and environment along the alignment (Government agencies and NGO);
- The Government authorities in Tajikistan – to ensure that the project can be designed and constructed to meet all environmental legislation applicable to Tajikistan;
- International Financial Institutions (IFIs) – In this case the Asian Development Bank (ADB), the European Bank of Reconstruction and Development (EBRD) and the Asian Infrastructure Investment Bank (AIIB) who need to be assured that the project will be designed, constructed and operated within the policy requirements of the IFI in order that funds can be released for the design, construction and operation of the project.
- Construction Phase Contractors – A Contractor will be employed by the Government of Tajikistan to build each package of the project. The EIA document will be used by the Contractor to confirm the environmental, social, health and safety factors that they must incorporate into their working processes. As part of this EIA, an Environmental Management Plan (EMP) has been prepared, that will be updated during the construction and operational phases as further details are made available. It will identify the environmental and social issues that will need to be addressed.
- In turn, as part of the Contract requirements, the Contractor will prepare a Site Specific Environmental Management Plan (SEMP) that will detail how the contractor will carry out the works in accordance with the EMP. This Contractor generated document will be approved by the client and become part of the construction contract and environmental performance will be audited against this document.

400. In terms of the assessment the public, Government authorities and the IFIs look to confirm that environmental “aspects” are addressed i.e. noise and air quality impacts, water quality impacts, ecological impacts, etc. Therefore the impact section assesses the project under these topics. However, the Contractor looks at the project in terms of processes i.e. setting up and operating a construction camp, setting up and operating processing facilities (quarries for material, crushing and grading facilities and concrete and bitumen manufacturing and the road construction process of filling, rolling and grading and forming the base and running surface of the road and erecting road safety element. The impact assessment reports under these headings which are taken forward into the EMP.

401. The sections of the Assessment Process are:

- Baseline data collection – Site visits, document review, preparation of a Rapid Environmental Assessment (REA), and a scoping exercise to identify key environmental, social and safety issues;
- Design Phase mitigation – environmental, social and safety elements that the design consultant needs to incorporate into the design.
- Construction Phase impacts and effects – identification of the environmental, social and safety impacts and effects during the construction phase.
- Construction Phase mitigation – Mitigation measures that need to be undertaken by the Contractor during the construction phase;
- Operation Phase impacts and effects– identification of the environmental, social and safety impacts and effects during road operation
- Operation Phase mitigation – Mitigation needed during the operational phase of the road.

7.1.1.1 Risk Matrix Approach for Impact Assessment

402. The assessment of impact will follow a risk matrix approach where the likelihood of an environmental, safety or social impact occurring is matched with the consequence (severity) of the impact occurring. The matrix ranks potential risks as low, medium, high or extreme, identifying the need for mitigation, and incorporation into the EMP. The assessment of potential severity of the impacts takes into consideration the presence and vulnerability of sensitive receptors, and adopts a precautionary approach.

403. All risks classified as medium or higher are considered significant, and require mitigation.

404. Figure 41 sets out the risk matrix derived for this project. This matrix approach should be adopted by the Contractor when they are developing their own SEMP.

[illegible]

405. The potential adverse environmental and social impacts for each of these construction and operational phase impact areas are described in the following sections..

406. The design consultants have reviewed the works carried out during the Soviet era and concluded that modification was needed to bring the road design (primarily road safety and engineering design requirements) up to current standards. This required modifications to cut slopes (flatter slopes for slope stability), road curvature (to maintain safe design speeds on the alignment) and the modification / reconstruction of bridges that had suffered from lack of maintenance creating structural safety (durability) issues. The two soviet era tunnel sections (Kandak and Karagach) and the new tunnel section (Tagikamar) are all new designs.

- Realignment to avoid a cemetery on the original routing (km 70 +500);
- Addition of the Tagikamar tunnel, tunnel no 3, (Package 2) to eliminate a stretch of winding road, improving journey times and road safety;

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- less noise during operation, compared to concrete (less noise nuisance for nearby residents and wildlife);
- less vibration compared to concrete (many buildings along the alignment are observed to be of mudbrick construction);
- better visibility of road markings on black asphalt (edge and lane markings – so improved road safety);
- better in winter snow/ice melt – it absorbs more heat from the sun causing snow and ice to melt much quicker, and is not affected by frost heave, or road salt;
- it can be recycled more easily than concrete and is generally cheaper to maintain.

409. A number of design amendments were made to improve road safety on the alignment, as a response to community consultations and a road safety audit conducted in November 2018⁸³, as follows:

- An advisory 40 km/h speed limit in villages will be applied. This may be made mandatory subject to approval by the MoT and the Tajik Traffic Police.
- At the location of the crossings in villages, there will be a raised “island” across the parking lanes, which means that although the parking lanes will increase the road width to 4 lanes in the villages, the raise islands will reduce it back to 2 lanes at these locations, so pedestrians will only need to cross a maximum of 2 lanes at any location.
- The provision of parking lanes in villages may provide an economic opportunity, as they provide a location for drivers to stop and rest, and a location where local people can sell produce;
- Crossing points will be moved away from the apex of intersections and – away from the path of turning traffic – to reduce the potential for accidents;
- Warning signs will be installed at all pedestrian crossings;
- Various improvements to road markings and signage; and
- Modifications to proposed tunnel control offices to improve operator safety during access / exit.

410. Provision will be made for the installation of 6 inch pipes at intervals below the carriageway in residential areas to allow passage of water pipes and other village services. The location of the pipes will be finalised in discussion with the local communities. The 6 inch pipes would provide a conduit for water pipes, and ensure they can be maintained and replaced without excavating the carriageway. This design solution would avoid the need to excavate the carriageway to maintain the water pipes.

411. The designer will aim to maximise the operational lifespan of the project and minimise the need for maintenance and refurbishment (and all associated emissions). Highly efficient mechanical and electrical equipment, such as light emitting diode (LED) lighting will be used within the designs.

412. The environmental, social and safety design elements outlined above, and the mitigation measures set out in the Environmental Management Plan (EMP), will be incorporated into the tender specifications for the construction Contractors, in line

⁸³ Detailed design stage road safety audit report for the proposed Obigarm-Nurabod Highway, northern Tajikistan, Road Safety International

with the relevant procurement processes of each IFI. Contractors will be obliged to include provisions for developing and implementing these actions and management plans.

7.3 Construction Phase Impacts and Mitigation

413. The following paragraphs identify the potential impacts and effects from the construction of the project. The information is entered into a risk matrix (likelihood of an event occurring against the consequence / severity of an event) to give a risk rating ranging from Low (low likelihood and little effect up to Extreme (where the event has a high possibility of occurring with irreversible and resource consuming consequences). The completed Construction Phase Risk matrix is included as Annex 6.

7.3.1 Degradation of Landscapes and Soil Erosion

7.3.1.1 Impacts

414. Some areas are sensitive to soil erosion, particularly when surface vegetation is removed, and when this is combined with rain events. Large expanses of open ground (cuttings and embankments) are not visually attractive. When undertaking earth works and levelling areas anti-erosive measures should be implemented and speedy re-cultivation should be followed to stabilise the soil and reduce the visual impacts.

7.3.1.2 Mitigation

415. Excavation of borrow pits will be avoided where possible by reuse of existing spoil in construction, and locations will be selected in a manner that aims to minimise visual impacts.

416. The road width and the temporary construction working areas adjacent to the road alignment, that will require clearing to construct the road, will be clearly demarcated on the ground, using marker posts at regular intervals. The Contractor will take measures to ensure the construction works are restricted to the demarcated construction working areas.

417. During land clearing operations, topsoil will be collected, preserved, store using good practice measures, and reused as a base for turfing of embankment slopes or development of barren areas along the road side.

418. After completion of construction and rehabilitation works, and after the use of borrow pits, the landscape shall be restored to a standard that is of equal quality to its original condition. Plant species that are native to the project area shall be used.

419. The need for on site environmental action to preserve landscapes and minimise soil erosion are identified in the EMP section of this EIA. The precise mechanisms will be identified in the SEMP, but Contractors will be required to develop and implement the following management plans, which will be approved and monitored during construction by the PIURR and Supervising Engineer:

- Landscape and Visual Management Plan
- Soil, Erosion and Topsoil Management Plan
- Waste and Materials Management Plan (particularly with regards to borrow pits)

420. Additionally, location specific mitigation measures will be covered by the required plans for these operations, including:

- Camp Management Plan
- Concrete and Asphalt Production Management Plans
- Construction Plans and Method Statements
- Method Statements for Temporary Activities

421. With mitigation in place the post mitigation risk is assessed as “low”, and effect is not considered significant.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Degradation of landscapes and soil erosion	MINOR	IMPROBABLE	LOW	NO

7.3.2 Soils, Geology and Hydrogeology

7.3.2.1 Impacts

422. Soil and water contamination can occur as a result of accidental spillages, such as oil leakage from machinery and stock piled construction materials and asphalt, oil products and chemicals, penetrating into the soil and/or surface or ground water.

423. The construction process can result in adverse impacts away from the alignment, through migration of spilled liquids, silty run-off and oil leakage from poorly maintained mechanical plant or during refuelling. This run-off can enter soils and potentially migrate to groundwater or, via underground flow, to surface water bodies, and adversely affect downstream communities and aquatic ecology.

7.3.2.2 Mitigation

424. Mitigation is generally in the form of good site practices implemented by the contractor and checked during periodic audit by the supervising engineer. Mitigation measures include using bunds to guide unpolluted water generated upstream from the alignment around construction works areas, to the downstream unpolluted, silt traps and bunds on the downstream side of the site. Together with sumps for settlement before discharge, drip traps and good maintenance of equipment.

425. This will require management by the contractor in the relevant management plans in their SEMP. It has been incorporated into EMP for contractor implementation, which should be secure via their contract. With these mitigation measures adopted by the contractor in the SEMP, impacts can be reduced to an acceptable level. The precise mechanisms will be identified in the SEMP, but Contractors will be required to develop and implement the following management plans, which will be approved and monitored during construction by the PIURR and Supervising Engineer:

- Water Resources Management Plan, including:
 - Ground Water Management

- Waste Water Management
- Emergency Response Plan, including:
 - Spill Management Plan
- Waste and Materials Management Plan (WMMP), including:
 - Spoil Disposal Plan
 - Asbestos Management Plan
- Soil, Erosion and Topsoil Management Plan

426. Additionally, location specific mitigation measures will be covered by the required plans for these operations, including:

- Camp Management Plan
- Concrete and Asphalt Production Management Plans
- Construction plans and Method Statements
- Method Statements for Temporary Activities

427. Landslide and erosion impacts are covered in Section 5.7 -Natural Hazards.

428. With mitigation in place the post mitigation risk matrix is assessed as “low” , and the effect is not considered significant.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Pollution of soils, geology and hydrogeology by construction runoff and accidental spills	MINOR	POSSIBLE	LOW	NO

7.3.3 Climate Change - GHG Emissions Due to Construction

7.3.3.1 Impacts

429. Addressing GHG emissions is a specific requirement of the EBRD reporting process this EIA section refers to the EU EIA Directive, because all EBRD Category A projects require an EIA aligned with EU legislation. The requirement to consider climate change in EIA, results from the 2014 amendment to the EIA Directive (2014/52). This requires “a description of the likely significant effects of the Proposed Scheme on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the Proposed Scheme to climate change.”

430. To meet this requirement an assessment of GHG emissions arising due to construction has been undertaken. This is because the impacts of GHGs directly contribute to climate change. These impacts are global and cumulative in nature, with every tonne of GHGs contributing to impacts on natural and human systems. GHG emissions result in the same global effects wherever and whenever they occur, therefore the sensitivity of different human and natural receptors is not considered.

431. GHGs are natural and anthropogenic gases that occur in the atmosphere and absorb and emit infrared radiation thereby maintaining the Sun’s energy within the Earth’s atmosphere. There is an scientific consensus that the major increase in the

concentration of GHGs from man-made sources is contributing to global warming and climate change.

432. The seven main GHGs defined by the Kyoto Protocol are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons, perfluorocarbons, Sulphur hexafluoride and nitrogen trifluoride. In combination, these GHG emissions are commonly expressed in terms of carbon dioxide equivalents (CO₂e) according to their relative global warming potential. For this reason, the shorthand 'carbon' may be used to refer to GHGs.
433. The first step in this assessment of GHG emissions was to set the scope of the assessment. Emissions sources were included or excluded from the assessment, based on their potential to result in significant emissions. The scope of this assessment has been informed by professional judgement and is summarised in Table 31.

Table 31: Scope of Construction Greenhouse Gas (GHG) Assessment

Emissions source	PAS2080 Ref ⁸⁴	Scope	Justification
Emissions 'embodied' within the construction materials	A1-3	In	Emissions from the construction materials of the Project are expected to have a large magnitude.
Transport of materials to site	A4	In	Emissions from the transport of materials to site are expected to have a large magnitude
Plant use on site	A5	Out	Emissions from the use of plant on site are expected to have a small magnitude compared to other emissions sources based on professional judgement based on previous project experience.
Transport of construction waste	A5	Out	Emissions from the transport of construction waste Project are expected to have a small magnitude.
Disposal of construction waste	A5	Out	Emissions from the disposal of construction waste, which is expected to be predominantly inert, are expected to be small.
Land use change – removal of Biomass	A5	Out	Emissions from the removal of biomass are expected to be negligible

434. Having set the scope of the assessment, the next step was to quantify the magnitude of emissions. This was undertaken using Project design information, and emissions factors available from publicly available sources. Assumptions were

⁸⁴ PAS2080 Refs are lifecycle reference codes used to consistently define construction Project lifecycle stages – BSI (2006) PAS2080: Carbon Management in Infrastructure
<https://shop.bsigroup.com/ProductDetail?pid=000000000030323493>

used where data was unavailable. This assessment limitation means that there is a very high level of uncertainty associated with the results published in this chapter. As such it is recommended that this assessment, and its scope, is reviewed and updated once further information is available. The design information, assumptions and emissions factors used in this assessment are presented in Table 32.

Table 32: Design Information, Assumptions and Emissions Factors in GHG Assessment

Description	Data type	Value	Unit	Source
Total bridge length	Design information	1,057	m	Inception Report (draft 2) Assessment of Climate Change Risks to Vahdat-Kyrgyz Border Rehabilitation Project
Bridge material	Assumption	100% Steel	N/A	Assumption - based on design of longest bridge
Bridge material quantity	Assumption	35	t/m	Assumption - Other bridge examples
Steel emissions factor	Emissions factor	1.46	tCO ₂ /t	Hammond and Jones 2011 Inventory or Carbon and Energy
Total tunnel length	Design information	5901	m	Inception Report (draft 2) Assessment of Climate Change Risks to Vahdat-Kyrgyz Border Rehabilitation Project
Tunnel external diameter	Design information	11	m	Inception Report (draft 2) Assessment of Climate Change Risks to Vahdat-Kyrgyz Border Rehabilitation Project
Lining thickness	Assumption	0.5	m	Assumption - Other tunnel examples
Tunnel material	Assumption	100% tunnel lining	N/A	Assumption
Concrete emissions factor	Emissions factor	0.107	tCO ₂ /t	Hammond and Jones 2011 Inventory or Carbon and Energy
Total length of new road	Design information	75.85	km	Inception Report (draft 2) Assessment of Climate Change Risks to Vahdat-Kyrgyz Border Rehabilitation Project
Road works	Assumption	100% new road	N/A	Assumption
Road surface width	Design information	12	m	Design drawing

Description	Data type	Value	Unit	Source
Road base width	Design information	14	m	Design drawing
Road surface depth	Assumption	0.1	m	Assumption - standard road construction
Road base depth	Assumption	0.5	m	Assumption - standard road construction
Road surface material	Assumption	Asphalt	N/A	Assumption
Road base material	Assumption	Aggregate	N/A	Assumption
Asphalt	Density	2300	kg/m ³	Hammond and Jones 2011 Inventory or Carbon and Energy
Aggregate	Density	2240	kg/m ³	Hammond and Jones 2011 Inventory or Carbon and Energy
Asphalt	Emissions factor	0.086	tCO ₂ /t	Hammond and Jones 2011 Inventory or Carbon and Energy
Aggregate	Emissions factor	0.0052	tCO ₂ /t	Hammond and Jones 2011 Inventory or Carbon and Energy
Transport Distance	Assumption	50	km	RICS 2017 Whole life carbon assessment for the built environment
Transport emissions factor	Emissions factor	0.203	t.km	GHG Protocol 2017

435. Using the above information and assumptions, it was possible to quantify emissions from construction materials and transport for the Project. The results of this assessment are presented in Table 33.

Table 33: Results of GHG Assessment

Emissions source	Emissions embodied in the materials(A1-3) - tCO ₂	Emissions from Transport of Materials (A4) - tCO ₂	Total - tCO ₂
Bridges	54,000	400	54,000
Tunnels	23,000	2,000	25,000
Road surface	15,000	18,000	34,000
Total	92,000	21,000	113,000

7.3.3.2 Mitigation

436. The contractor will maximise the use of construction materials and products with recycled or secondary and low carbon content, from renewable sources, and offering sustainability benefit. The contractor will use locally-sourced materials where available and practicable will be used to minimise the distance materials are transported from source to site. Efficient construction plant and delivery vehicles, and / or those powered by electricity from alternative / lower carbon fuels will be used during construction, where possible.

437. With mitigation in place the post mitigation risk is assessed as “low” , and the effect is not considered significant.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Climate change – GHG emissions	MINOR	POSSIBLE	LOW	NO

7.3.4 Climate Change – Adaptation and Resilience of the Project

7.3.4.1 Impacts

438. Addressing Climate Change is a specific requirement of the EBRD reporting process and is included by EBRD in this EIA. Climate change and associated natural hazards is a key issue affecting road infrastructure during both construction and operation. The climate change and seismic risks to the project were assessed under separate dedicated assessments which aimed to identify material climate change related risks to the project and propose mitigating structural and non-structural improvements to increase the project’s resilience. “Assessment of climate change risks to Vahdat – Kyrgyz Border Rehabilitation Project” contracted by EBRD covers the climate risks to package 2, and a Climate Risk and Vulnerability Assessment screening contracted by ADB was undertaken for package 1. The assessments identified the following relevant hazards to the project:

- Increasing ambient average temperature and temperature ranges;
- Increasing average precipitation and short-term heavy rains;
- Increase in melted water coming from higher altitudes resulting in an increase in slush flows on the Road or around the Road;
- Increasing average levels of wind and short-term stronger winds;
- Changes in seismicity.

7.3.4.2 Mitigation

439. Relating to impacts identified during the construction phase the EMP section of this EIA outlines the actions that will be included in a Climate Resilience Construction Management Plan, to be developed by the PIURR and approved by Supervising Engineer.. Contractors will be required to develop and implement measures to comply with this plan.

440. With mitigation in place the post mitigation risk is assessed as “medium” and is recommended to be monitored throughout construction.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Climate change resilience	MAJOR	PROBABLE	MEDIUM	YES

7.3.5 Natural Hazards – Seismic Conditions

7.3.5.1 Impacts

441. The project road is located in region that is seismically active and categorised as a very high seismic hazard zone of PGA > 0.4g.. It is in a zone subject to 9-magnitude earthquakes on the Medvedev–Sponheuer–Karnik (MSK-64) scale. The project will be result in the creation of a new road and structures in this area that have the potential to be vulnerable to these natural hazards.

7.3.5.2 Mitigation

442. To mitigate this potential vulnerability, the road and associated structures have been designed in accordance with the Tajik Seismic Code GNIP RT 22-07-2015⁸⁵. The factor used on the MCK 64 scale is 9 (the highest), to ensure the road and associated structures are able to withstand seismic activity of this scale.

443. Specific design features have been incorporated into the design to mitigate seismic hazards.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Natural Hazards – Seismic Hazards	MAJOR	IMPROBABLE	MEDIUM	NO

7.3.6 Natural Hazards – Landslides, Mudslides and Floods

7.3.6.1 Impacts

444. The project area is susceptible to landslides, mudflows and floods. The project road has the potential to increase the likelihood of landslides and mudflows occurring, due to the construction works, such as cuttings, embankments, tunnelling, bridge foundations and vegetation clearance.

445. The project also has the potential to be vulnerable to landslides, mudslides and floods, with associated risks to construction workers, and the surrounding communities. The engineering Geology Survey summary is included as Annex 3 in the EIA Volume 2. The geological studies have identified risk issues (potential for mudflows, landslide / rockfalls, snow avalanche, etc.) and options for remedial actions in the design (additional backfilling, retaining walls, slope stabilisation,

⁸⁵ Architecture and Construction Committee Under the Government of the Republic OF Tajikistan – City Construction Norms and Rules Republic of Tajikistan GNIP RT 22-07-2015 Earthquake Resistant Construction

removal of unstable material, protective structures, widened bench slopes, etc.) With these arrangements in place acceptable levels of impact have been incorporated into the design of the project.

7.3.6.2 Mitigation

446. A Slope Stabilisation Plan will be developed and will determine the specific areas of slope stabilisation works ahead of construction, reducing the risk of landslides, mudslides, and therefore the risk to construction workers and surrounding communities. The Water Resources Management Plan will prevent the construction activities increasing the risk of floods occurring, and the severity of the consequence. The Construction Plans and Method Statements Plans will outline the specific construction techniques for each element of the Project to ensure the construction activities do not increase the risks associated with natural hazards. A Tunnel Construction Plan and Blasting Management Plan will also be developed to minimise the risk of the construction works resulting in these hazards, or being affected by them. All Construction Plans will cross reference relevant; environmental, social and health and safety sub-plans.
447. The Avtostrada Engineering Geology Surveys⁸⁶ identified locations along the route where there is potential for dangerous geological processes (landslides and mudslides) and recommended specific mitigations for each location. These are provided in Annex 3. These will be implemented as appropriate during construction.
448. On-site analysis will also be conducted and additional stabilisation measures applied as necessary, including facing unstable slopes with rock mortar, reinforcing walls, gabion walls, smaller reinforced concrete walls to stop erosion of poorer materials, rock mortar facing to prevent erosion.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Natural Hazards – Landslides, Mudslides & Floods	MAJOR	IMPROBABLE	MEDIUM	NO

7.3.7 Construction Noise

7.3.7.1 Impacts

⁸⁶ Vahdat – Rasht – Jirgatal – Kyrgyzstan Border Road (From km 72 to km 158), Stage II Road Section From Chainage 424+80 To Chainage 759+14: Technical Report On The Results Of Engineering-Geological Surveys For The Development Of Working Design: Ref 16-16-Egs, Dushanbe, 2018; and Vahdat – Rasht – Jirgatal – Kyrgyzstan Border Road (From km 72 to km 158), Stage II Road Section From Chainage 0 to Chainage 424+80: Technical Report On The Results Of Engineering-Geological Surveys For The Development Of Working Design: Ref 16-16-Egs, Dushanbe, 2018

449. During construction works, airborne noise is generated by construction equipment such as milling machines, excavators, bulldozers, pavers, compactors and generators.
450. Construction noise control should be based on a balance between the interests of those who want to build and possible annoyance by neighbours near the building site. The value of the construction activities for society is commonly recognized, however, people exposed to the involved noise emission expect a responsible approach to minimize the annoyance of such activities.
451. The methodology for assessing the effects of construction noise from the Project can be divided into following general steps:
- Establish, through measurement, the current ambient noise environment for sensitive receptors that may in future be affected by construction noise from the Project [SEP]
 - Identify those construction activities with the potential to generate significant construction noise levels [SEP]
 - Analyse obtained equipment data and calculate noise emission at the source; [SEP]
 - Assess the noise effects of the Project; [SEP]
 - Develop best practicable noise mitigation measures.
452. *In assessing Construction noise impact, site working hours are assumed to be from Monday to Saturday from 8 am to 6 pm. Night-time working and working on Sunday or public holidays is not foreseen.*
453. There is limited information available on construction methods, plant and equipment before the Works Contract is awarded, but based on the anticipated scope of works it can be assumed that standard construction methods and equipment would be used for the civil works for rehabilitation and upgrading of the project road.
454. An assessment of construction activities and construction plant associated with these activities has been carried out and is identified in. Fixed / stationary plant and equipment are not considered, as the location of the stationary plants should be selected with due regard to sensitive receptors, see following table.

Table 34: Construction activities and construction plant associated with activity

Activity	Equipment	Work Site Location
Demolition / Breaking Up Concrete	Hydraulic hammers Wheeled Loader Trucks Excavators Breaker	Existing structures (bridges and culverts) and houses to be demolished
Site Clearance	Milling machine Wheeled Loader Trucks Excavators Dozer	Across the work site
Earthworks	Excavators Loaders	Across the work site

	Dump trucks Graders Dozers Vibrating rollers Compactors	
Bridge/Structure Works	Excavators Drilling Rig Concrete Mixer Trucks Concrete pumps Trucks Crane Poker Vibrator Diesel Generator	At all bridge location
Road Pavement Works	Water Tanker Graders Road Sweeper Bitumen Sprayer Paver Multi-tryed Rollers	Across the work site

455. Ideally, noise data in calculations should be for the specific equipment to be used on site. However, at the assessment stage the equipment has not been selected, and data are not available. Therefore, for initial predictions reference noise data from BS 5228-1:2009 has been used.

456. BS 5228-1:2009 includes reference noise level data for typical construction equipment. These data have been obtained from measurements at construction sites in the United Kingdom on similar types of equipment to that used internationally. These data are used as a guide to establish the construction noise emissions.

457. Where there is a moving source, the BS 5228-1 data relates to the equipment at the nearest (loudest) point rather than being an average value. For slow-moving sources in a constrained area, BS 5228-1 makes allowance for the times when the equipment is further away from the houses and therefore quieter. This is done by effectively reducing the operating time, using the correction factor extracted from equation F9 within BS 5228-1:

$$L_{Aeq(T)} = 10 \log 10 \frac{1}{T} \sum_{i=1}^n t_i 10^{0.1 L_i}$$

where:

$L_{Aeq(t)}$ is the is the combined equivalent continuous A-weighted sound pressure level, in decibels (dB), over a given period T;

L_i is the individual equivalent continuous A-weighted sound pressure level, L_{Aeq} , for an item of plant or activity during a period t_i , in decibels (dB);

n is the total number of individual equivalent continuous A-weighted sound pressure levels to be combined.

458. The Table below presents the A-weighted sound pressure level at 10 m for the anticipated generic construction equipment together with an estimate on the length of time the construction equipment is used.

Equipment Description	BS 5228-1 Reference	Sound Pressure Level, dB, at 10 m	Duration of Activity as percentage of 10 h (On time) %
Asphalt Paver	Table C5, Ref. No. 33	75	60
Breaker (Pneumatic)	Table D2, Ref. No. 11	87	50
Concrete Mixer Truck	Table C4, Ref. No. 27	79	80
Concrete Pump	Table C4, Ref. No. 29	80	80
Compactor	Table C8, Ref. No. 1	80	80
Crane	Table C5, Ref. No. 37	76	60
Diesel Generator	Table C4, Ref. No. 85	66	100
Dozer	Table C2, Ref. No. 1	75	80
Drilling Rig	Table C3, Ref. No. 14	83	80
Excavator	Table C5, Ref. No. 18	80	80
Grader	Table D9, Ref. No. 7	83	80
Hydraulic hammers	Table C1, Ref. No. 7	93	50
Milling Machine	Table C5, Ref. No. 7	82	80
Multi-tired Roller (asphalt)	Table C5, Ref. No. 29	82	80
Poker Vibrator	Table C4, Ref. No. 34	69	80
Road Sweeper	Table C4, Ref. No. 90	76	20
Truck	Table C2, Ref. No. 30	79	60
Vibrating Roller	Table C5, Ref. No. 28	77	60
Water Tanker	Table C4, Ref. No. 89	79	50
Wheeled Loader	Table C2, Ref. No. 28	76	80

7.3.7.2 Calculation of Construction noise

459. The tables below contain summary noise emission levels for major construction activities to be undertaken for rehabilitation of the project roads. To calculate the combined noise level for a construction activity the following equation has been used to combine the noise levels from the individual construction equipment:

$$\text{Combined Noise Level} = 10 \times \log_{10} (10^{(L1/10)} + 10^{(L2/10)} + \dots + 10^{(Ln/10)})$$

where: L = individual noise events

Table 35: Noise Generation for demolition / concrete breaking

Equipment Type	Noise level at 10 m L _{Aeq} (dB)	Duration of Activity as percentage of 10 h	Correction to L _{Aeq} (dB)	Activity Noise Level L _{Aeq(10)} (dB)
Hydraulic Hammer	93	50	-3.0	90.0
Breaker	87	50	-3.0	84.0
Excavator	80	80	-1.0	79.0
Wheeled Loader	76	80	-1.0	75.0
Truck	79	60	-2.2	76.8
Total Activity				91.5

Table 36: Noise generation for Site clearance work

Equipment Type	Noise level at 10 m	Duration of Activity	Correction to	Activity Noise Level
	L _{Aeq} (dB)	as percentage of 10 h	L _{Aeq} (dB)	L _{Aeq} (10) (dB)
Milling Machine	82	80	-1.0	81.0
Dozer	75	80	-1.0	74.0
Excavator	80	80	-1.0	79.0
Wheeled Loader	76	80	-1.0	75.0
Truck	79	60	-2.2	76.8
Total Activity				84.9

Table 37: Noise generation for earthworks

Equipment Type	Noise level at 10 m	Duration of Activity	Correction to	Activity Noise Level
	L _{Aeq} (dB)	as percentage of 10 h	L _{Aeq} (dB)	L _{Aeq} (10) (dB)
Excavator	80	80	-1.0	79.0
Wheeled Loader	76	80	-1.0	75.0
Excavator	80	80	-1.0	79.0
Truck	79	60	-2.2	76.8
Grader	83	80	-1.0	82.0
Dozer	75	80	-1.0	74.0
Vibrating Roller	77	60	-2.2	74.8
Compactor	80	80	-1.0	79.0
Total Activity				87.3

Table 38: Noise generation for bridge works

Equipment Type	Noise level at 10 m	Duration of Activity	Correction to	Activity Noise Level
	L _{Aeq} (dB)	as percentage of 10 h	L _{Aeq} (dB)	L _{Aeq} (10) (dB)
Excavator	80	80	-1.0	79.0
Drilling Rig	83	80	-1.0	82.0
Concrete Mixer Truck	79	80	-1.0	78.0
Concrete Pump	80	80	-1.0	79.0
Truck	79	60	-2.2	76.8
Crane	76	60	-2.2	73.8
Poker Vibrator	69	80	-1.0	68.0
Diesel Generator	66	100	0.0	66.0
Total Activity				86.7

Table 39: Noise generation for road pavement works

Equipment Type	Noise level at 10 m L _{Aeq} (dB)	Duration of Activity as percentage of 10 h	Correction to L _{Aeq} (dB)	Activity Noise Level L _{Aeq(10)} (dB)
Water Tanker	79	50	-3.0	76.0
Graders	83	80	-1.0	82.0
Road Sweeper	76	20	-7.0	69.0
Bitumen Sprayer	79	50	-3.0	76.0
Asphalt Paver	75	60	-2.2	72.8
Total Activity				84.2

7.3.7.3 Impacts of Construction

460. The potential noise impacts during the construction are presented in the following table. All noise predictions are for a circumstance where specific or general noise mitigation has not been implemented on site. Therefore, noise levels from the activity would generally be lower than shown in the tables. The predicted noise levels in the tables represent the highest noise level likely to be received from the construction site without any mitigation. It should be noted that noise emissions would vary as construction progresses and the inherent variability in construction noise makes it very difficult to predict.

Table 40: Construction noise levels at distances from the works

Activity	Activity Noise Level				
	at 10 m (dB)	at 20 m (dB)	at 50 m (dB)	at 100 m (dB)	at 200 m (dB)
Demolition	91.5	85.5	77.5	71.5	65.5
Site Clearance	84.9	78.9	70.9	64.9	58.9
Earthworks	87.3	81.3	73.3	67.3	61.3
Bridge/Structure Works	86.7	80.7	72.7	66.7	60.7
Road Pavement Works	84.2	78.2	70.2	64.2	58.2

461. The IFC guideline allowable noise level at a residential property is 55 dB(A) for day time. Noise impact will be reduced to this level due to distance attenuation at the following distances:

- Demolition 670 m
- Site Clearance 312 m
- Earthworks 410 m
- Bridge/Structure Works 385 m
- Road Pavement Works 290 m



Figure 42: Distances needed to attenuate construction noise (distance alone)

7.3.7.4 Mitigation

462. The noise impact of the construction phases can be minimised by use of the noise control measures, as suggested in Section 8 of BS 5228-1:2009. During noisy activities the contractor shall minimise noise impact by use of natural topographic barriers or by placing physical barriers between noise generating activities and sensitive uses and only work during daytime hours, unless dispensation is arranged. To minimise noise impacts on nearby residents all vehicles will be equipped with exhaust mufflers and regularly inspected to ensure they are operating efficiently. In addition, works sites will only operate during daytime hours. Blasting, or other high noise activities (such as asphalt plants, cement plant, and stone crushers) should not be carried out in the early morning or evening when background noise levels are low. All residents that will be affected should be informed of the date and time of blast well in advance. Blasting should preferably be carried out at the same time each day.

463. The construction contractor will be required to monitor construction noise levels at sensitive locations during construction activities to confirm that compliance with the noise criteria is achieved and that additional noise attenuation measures are not required for construction equipment, vehicles or activities.

464. The most effective method to control construction noise is through proactive management. This includes assessment of all activities and consideration of potential noise and appropriate mitigation.

465. Construction activities should be scheduled to minimise the multiple use of the most noisy items of equipment near sensitive receivers

466. Noise impacts along construction access routes will also need to be considered during route selection.

467. Noise standards to be applied during construction are presented in Table 41. in These criteria draw from a review of Tajik and international standards. These levels

should be applied at receptors in the vicinity of the Project. The derivation of these standards is described in more detail in Table 10 of this EIA.

Table 41: Noise Standards for Construction

Receptor Type	Noise Standard dB(A)		
	Daytime (0700-2300)*	Night time (2200-2300)**	Night time (2300-0700)*
Wards, operating rooms, clinics, consultation rooms, dispensaries in hospitals and sanatoriums	35		30 [‡]
Recreation areas on the territory of hospitals and sanatoriums	35		30 [‡]
Classrooms, teachers' general office, school and other conference rooms of other educational organizations, as well as public reading rooms	40		30 [‡]
Living quarters in apartments, rest houses, boarding houses, homes for the elderly and disabled, sleeping quarters in kindergartens, as well as residential schools	40		30
Rooms in hotels and hostels	45		35
Halls in cafeteria, restaurants, tables	55	45	
Shops trading halls, passenger halls at airports and train stations, consumer services centres	60	45	
Recreation areas, directly adjacent hospital buildings and health centres	45		35
Areas directly adjacent to residential buildings, clinics, dispensary, rest homes, homes for the elderly and disabled, kindergartens, schools and other educational institutions, libraries	55	45	
Territories directly adjacent hotels and hostels	60	45	

* - Tajik standards

** - IFC Standards⁸⁷

‡ - No specific standard identified. Standard for living quarters has been applied.

468. The requirements for noise mitigation are identified in the EMP section of this EIA. The precise mechanisms will be identified in the Contractor SEMP, where the Contractor will be required to develop and implement the following management plans, which will be approved and monitored during construction by the PIURR and Supervising Engineer:

⁸⁷ <https://www.ifc.org/wps/wcm/connect/06e3b50048865838b4c6f66a6515bb18/1-7%2BNoise.pdf?MOD=AJPERES>

- Noise and Vibration Management Plan (NVMP) Item 9 of EMP
- Traffic Management Plan (TMP)
- Blasting Management Plan

469. Additionally, location specific noise mitigation measures will be covered by the required plans for these operations, including:

- Camp Management Plan (EMP 24)
- Concrete and Asphalt Production Management Plans (EMP#25)
- Construction plans and Method Statements
- Method Statements for Temporary Activities

470. With mitigation in place the post mitigation risk is assessed as “low” , and th effect is not considered significant.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Construction noise	MINOR	IMPROBABLE	LOW	NO

7.3.8 Construction Phase Vibration (including blasting)

7.3.8.1 Vibration Impacts

471. The Project road passes through a number of discrete village developments on the alignment. Buildings within these settlements can be located close to the alignment and during construction phase could be affected by vibration due to the construction process (vibrating rollers). Therefore an assessment of the potential magnitude of vibration impacts is presented in this section.

472. Tajikistan has no national standards for vibration.

473. Baseline measurements vibration levels should be monitored during the construction phase within the settled areas crossed by the alignment. Vibration impacts along temporary access routes will also need to be considered during route selection.

474. Vibration caused by construction can cause disturbance to residents close to the works and damage to property. The effects of vibration on structures depends on the construction machinery and equipment used (emission source) and on the structural conditions of the potentially affected building structures (receptors).

475. The buildings within the Project area are relatively old structures, generally formed in locally sourced materials (wood and mud brick). At the west end of the alignment, close to Obigarm, there are some buildings constructed in blockwork, in particular new government buildings e.g. schools this is also the case at Daraban new town at the east end of the alignment. Many of the buildings are constructed within compounds of bud brick, blockwork or steel sheeting. Buildings were casually observed to be in good to fair condition and did not appear to be suffering from surface cracking due to ground settlement / poor foundations.



Plate 7: Buildings in Kandak - west end of the alignment (Nov 2018)



Plate 8: Buildings in Kandak are generally set back from the alignment (Nov 18)



Plate 9: School Building (no 6) Kandak village (Aug 2018)



Plate 10: Wood framed / mud walled building in Kandak (Aug 2018)



Plate 11: Blockwork construction in Darabad new-town - east end of alignment (Nov 18)

476. As there are no standards for vibration in Tajikistan threshold criteria recommended by USA CALTRANS (2013)⁸⁸ were used for the assessment of vibration on building structures. These criteria draw from a large review of international standards including, the American Association of State Highway and Transportation Officials (AASHTO), Swiss Association of Standardization, and British Standards. The cited threshold criteria are shown in Table 42.

⁸⁸ California Department of Transportation (2013): Transportation and Construction Vibration. Guidance Manual.

Table 42: Guideline Vibration Damage Potential Threshold Criteria

Structure and Condition	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1	0.5
Modern industrial/commercial buildings	2.0	0.5

Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

477. Existing buildings along the project road are predominantly buildings with plastered walls, wooden ceilings and walls in mud brick or blockwork. A conservative approach was adopted with older buildings taken as a reference for the assessment (worst case). This categorisation was based on the field observations, not a full structural survey. There are no facilities with equipment sensitive to vibration in the immediate vicinity of the alignment.

478. For historic and old buildings the given threshold (acceptable) value is 0.25 in/sec for continuous or frequent intermittent sources typical of construction vibration.

479. For the various type of construction machinery the average vibration levels at a distance of 25 feet (approximate 7.5 m) from the emission source are indicated in Table 43 (Caltrans 2013)⁸⁹:

Table 43: Vibration Source Amplitudes for Construction

Equipment	Reference PPV at 25 ft./ approximate 7.5 m (in/sec)	Reference in dB
Vibratory roller	0.210	106
Large bulldozer	0.089	98
Caisson drilling 0.089 98	0.089	98
Loaded trucks 0.076 97	0.076	97
Jackhammer 0.035 90	0.035	90
Small bulldozer 0.003 69	0.003	69

480. Using these source levels, vibration from the equipment can be estimated by the following formula:

- $$PPV_{\text{Equipment}} = PPV_{\text{Ref}} * (25/D)^n \text{ in/sec}$$

⁸⁹ California Department of transportation (2013): Transportation and Construction Vibration

- Where: PPV_{Ref} = reference PPV at 25 ft.
- D = distance from the equipment to the receptor in feet.
- $N = 1.1$ (the value related to the attenuation rate through ground)⁹⁰

481. By transposing this formula the required minimum distance can be calculated as follows:

$$D = \frac{25}{\sqrt[n]{\frac{ppv_{equipment}}{ppv_{ref}}}}$$

482. By applying this formula and using as threshold values for $PPV_{Equipment}$ and PPV_{Ref} 0.25 in/sec the calculated minimum safe distance for the fragile buildings adjacent to the project road is 25 feet (7.5 meters). The threshold value used for the building structures is valid for historic and old buildings and emission from a continuous source⁹¹. The reference PPV applied for the construction machinery (0,25 in/sec) is slightly above the standard PPV_{Ref} of the vibratory roller in Table 43. Hence the assessment can be considered to be conservative.

483. It is therefore be concluded that fragile buildings closer than 7.5 m to the future road edge are at risk of damage. There are discrete areas of residential development along the alignment. At these points an adverse impact from vibration may occur. Adverse impact is therefore expected and will require management by the contractor. The clauses identified here will be incorporated into the construction contract and are identified in the EMP.

7.3.8.2 Blasting impacts⁹²

484. The drill and blast method is the mostly used method for the excavation of tunnels throughout the world. The method can be used in all types of rocks and the initial cost is lower than mechanical methods like Tunnel Boring Machines (TBM). Drill and blast uses explosives compared to bored tunneling with a TBM. Rock blasting results in a higher duration of vibration. The excavation rate is also less than TBM (usually 3 to 5m a day).

485. Potential environmental impacts for drill and blast in terms of noise, dust and visual on sensitive receives are restricted to those located near the tunnel portal;

486. Disadvantages of drill and blast are potential hazard associated with establishment of a temporary magazine site for overnight storage of explosives. Ut this is addressed on this project by tunnels being located in remote areas away from population centres.

⁹⁰ The value 1.1 for n is suggested in CALTRANS (2013). It is used for class III soils which are defined as Hard Soils, such as: dense compacted sand, dry consolidated clay, consolidated glacial till, some exposed rock (cannot dig with a shovel, need a pick to break up)

⁹¹ Threshold criteria according to table 48 (Table 19 in CALTRANS (2013))

⁹² The assessment in this section is sourced from a similar project in Georgia. RRP GEO 50064 Georgia: Batumi Bypass Road Project (Part 2) [January 2017].

<https://www.adb.org/projects/documents/geo-batumi-bypass-road-project-jan-2017-eia>

487. Tunnels will be excavated using two methods: a) In soft materials excavators of 0.5 cubic meter (m³) capacity or excavators and jackhammers; and b) For hard material by drilling and blasting.
488. Airborne shockwaves are generated if a blast is carried out on the surface or near the surface. All blasting will be undertaken inside the tunnel and therefore airborne shockwaves are not considered to be an issue on this project for the three tunnels (six portals).
489. A secondary concern is flying rocks from a blast and this is dependent on rock type and explosive strength. Rocks can be projected upto 50 m from the blast site potentially damaging structures (though unlikely in this project as there are no buildings close to the portals) and raising the risk of injury or death to workers and the public. For this reason, surface blasting or blasting near the mouth of the tunnel should not be considered without additional reporting by the Contractor.
490. Underground blasting results in ground vibrations that cannot be confined to the site. The Project will conduct construction blasting consistent with Tajik and international safety standards. Blasting will be conducted using standard mining industry practices and procedures to ensure safety of personnel and equipment. This includes establishing a safety zone around the blast area, say to a distance of 500 m (actual distance will be established by the contractor based on the safety standards) and evacuating it.
491. Ground vibration is measured in terms of Peak Particle Velocity (PPV) with units in mm/s or mm/s⁻¹. It should be noted that the PPV refers to the movement within the ground of molecular particles and not surface movement. A displacement value in mm refers to the movement of particles at the surface (surface movement).
492. Environmental ground vibrations may cause annoyance to residents of nearby buildings both directly and via generated structure-borne interior noise and can also cause structural damage. Typical values of ground vibration particle velocity associated with vehicles passing over traffic calming road humps are in the range of 0.1 – 2 mm/s. There are clear limits mentioned for vibration due to construction/demolition in BS 5228-2. In table B.1 there is guidance on effects of vibration levels. These levels set out the human response to vibration (nuisance). For potential damage to buildings table B.2 is used. Depending on the type of building there are different limits which are generally higher than the nuisance limits. In general, magnitudes of ground vibrations that are considered to be able to cause structural damage to buildings are above 15 mm/s.

Prediction Model

493. Prediction of vibration levels at a location away from the blasting site is a complex function of blasting parameters and rocks through which the waves propagate. A number of site specific experimental formulae have been developed to predict and control blasting effects. All of these formulae have a similar form:

$$PPV = k \left(\frac{R}{Q^n} \right)^{-b}$$

where: PPV = peak particle velocity (mm/s);

k = site constant

R = distance to the point of concern (m);
 Q = maximum instantaneous charge weight;
 b = rock properties constant; and
 n = constant that depends on the geometry of the explosive.

494. Kumar et al (2016)⁹³ have listed 23 different formulae.

495. The constant n is generally taken as ½ in most of the studies. The predicted value of PPV critically depends on the empirical constants, k and b. These are considered site specific and are normally determined by blast experiments. In the absence of experimental data, as is the case with this Project, empirical models can be used to evaluate these constants. Because of wide variation in site condition—charge per delay, vibration frequency, rock characteristics (type, unit weight, layering, slope of layers), blast hole conditions, presence of water, propagation of surface and body waves in the ground, and method of initiation—the site-specific empirical equations, if used at other sites are likely to have large errors.

496. Kumar et al (2016), have studied the effects of important engineering properties of rock and have developed an empirical model that relates the unit weight, uniaxial compressive strength (UCS) and rock quality designation (RQD) with the PPV. This analysis uses the Kumar model for predicting the vibration levels.

497. According to Kumar's model

$$PPV = \frac{Fc^{0.642}}{\gamma} \left(\frac{R}{Q^{1/2}} \right)^{-1.463}$$

where: PPV = peak particle velocity (mm/s);

fc = UCS of rock R = distance to the point of concern (m);

Q = maximum instantaneous charge weight (kg);

γ = unit weight (kN/m³).

The value of fc is proposed as follows:

For RQD less than or equal to 75 $fc = 0.59476 \text{ RQD} + 0.00893 \text{ RQD}^2$

For RQD Greater than 75 $fc = -7.91562 \text{ RQD} + 0.12152 \text{ RQD}^2$

Composite Rock Property

498. The vibration from blasting will propagate through the rocks in the surrounding hills. Geological information on the rocks is not available. However, given that the rocks in the three tunnels are of similar nature, it is reasonable to assume that similar rocks will be present in the surrounding areas also. For the purpose of calculating the PPV of the vibration, a composite rock property has been developed. Several different types of rocks have been identified in the Project Area. Using the cross-sectional area of the rocks in these figures, the proportion of each

⁹³ Kumar et al., 2016

R. Kumar, D. Choudhury, K. Bhargava Determination of blast-induced ground vibration equations for rocks using mechanical and geological properties Journal of Rock Mechanics and Geotechnical Engineering, 8 (3) (2016), pp. 341-349

type of rock has been calculated. All properties are then calculated by taking weighted average of the individual rock type. The result is shown in Table 8-11.

Table 44: Composite Rock Property Calculation

	Rock Category 4, 3, and 14	Rock Category 15	Rock Category 16	Composite
Volume fraction (%)	67	9	24	100
RQD (%)	10	68	91	34.7
fc (MPa)	6.84	81.74	286.0	31.3
γ (kN/m ³)	26	27	27	26.3

499. RQD has been obtained from the geotechnical engineering report⁹⁴ whereas for γ the density of predominant rocks, andesite and basalt has been used. Both have a density of about 2.7 g/cm³. To obtain, unit weight it has been multiplied by the value of g, the acceleration due to gravity (9.81 m/s²).

Maximum Instantaneous Charge Weight

500. The mass of explosives required to break a unit volume of rocks, called the powder factor, depends on the strength of rocks and the type of explosives. The recommended typical powder factor for different types of rocks are given in Table 45⁹⁵.

Table 45: Powder Factor for Different Hardness of Rocks

Rock Type	Powder Factor (kg/m ³)
Hard	0.7 – 0.8
Medium	0.4 – 0.5
Soft	0.25 – 0.35
Very Soft	0.15 – 0.25

501. As basalt and andesite are both categorized as hard rocks⁹⁶, for this analysis the mean value for hard rock as shown in Figure XX⁹⁷ is taken.

502. The typical cycle of excavation by blasting is performed in the following steps:

- Drilling blast holes and loading them with explosives.
- Detonating the blast, followed by ventilation to remove blast fumes.
- Removal of the blasted rock (mucking).
- Scaling crown and walls to remove loosened pieces of rock.
- Installing initial ground support.

⁹⁴ Ministry of Regional Development and Infrastructure of Georgia, Road Department. Bidding Documents for Construction of Batumi Bypass Road Section Km. -1 +000~km. 13+325. Volume 3.2 Supplementary Information Geotechnical Engineering Report, Material Sources. October 2016

⁹⁵ Dyno Nobel. Blasting and Explosives Quick Reference Guide. 201

⁹⁶ Hard Rock Miner's Handbook Edition 5. Jack de la Verne, Stantec Consulting, 2014.

⁹⁷ <http://www.railsystem.net/drill-and-blast-method/>

- Advancing rail, ventilation, and utilities.

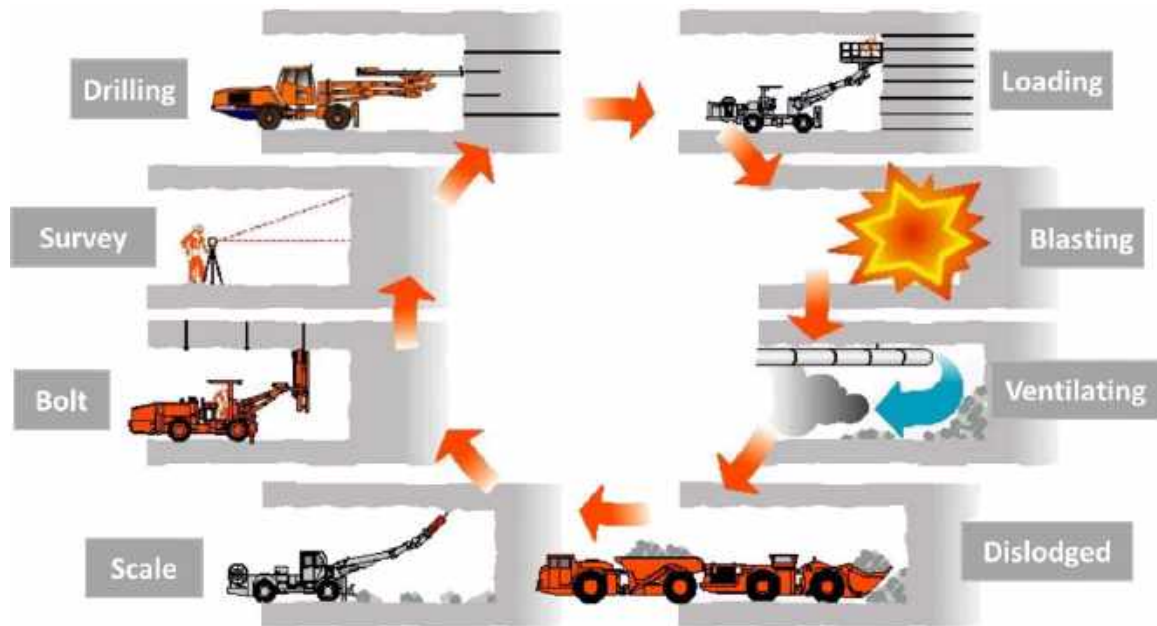


Figure 43: Typical cycle of tunnel excavation by blasting

503. The rate of advance depends on the depth of borehole. The total volume of rock removed in one cycle is equal to the cross-sectional area of the tunnel multiplied by the depth of the borehole. Once the volume is known the total quantity charge to be used in one cycle can be calculated by using the powder factor.

504. The drilling pattern ensures the distribution of the explosive in the rock and desired blasting result. Several factors must be taken into account when designing the drilling pattern: rock drillability and blastability, the type of explosives, blast vibration restrictions and accuracy requirements of the blasted wall etc.

505. Based on these considerations, the maximum instantaneous charge weight is calculated as shown in the following Table.

Table 46: Instantaneous Charge Weight Calculation

Parameter	Value	Explanation
Tunnel cross-section (m ²)	92	Calculated from drawings
Borehole depth (m)	5	based on personal communication with road construction engineer
Rock removed in one blast cycle (m ³)	460	(cross section x borehole depth)
Rock Type	Hard	
Powder factor (kg/m ³)	0.75	See Table 8.12
Total charge weight (kg)	345	(Rock removed x powder factor)
Maximum instantaneous charge weight (kg)	50	Estimated from typical borehole pattern and personal communication with road construction engineer

506. Using the rock parameters and instantaneous charge weight calculated above, the Peak Particle Velocity (PPV) at intervals of 10 m from the blasting site is calculated. The results indicate that for the given configuration, the applicable criteria of no damage (5 m/s) will be met at a distance of 130 from the blasting site. The PPV will exceed the threshold for structural damage (15m/s)⁹⁸ at a distance of 60 m from the blasting site. The results are shown in Table 8-14.

Table 47: Calculated PPV as Function of Distance from Blast Site

Distance from Blast Site (m)	PPV (mm/s)	Damage
10	208.9	structural damage Anticipated
20	75.8	
30	41.9	
40	27.5	
50	19.8	
60	15.2	
70	12.1	Potential structural damage
80	10.0	
90	8.4	
100	7.2	
110	6.3	
120	5.5	
130	4.9	No damage
140	4.4	
150	4.0	
160	3.6	
170	3.3	
180	3.0	
190	2.8	
200	2.6	

Important note on use of this table:

The above results are based on certain key assumptions and understanding. That are:

- The accuracy and representativeness of information in the Feasibility Study. This includes the rock type, rock type distribution, and RQD;
- The tunnel composition of rock type is representative of the entire area to allow developing property of composite rock;
- The assumptions about borehole depth (5 m), total rock blasted in one cycle (460 m3), powder factor (0.75) and maximum instantaneous charge (50 kg) are reasonable.

507. It is emphasized that these are assumptions and shall not be considered as binding. They are based on available information and have been selected as indicative of typical conditions that could be encountered in actual tunneling for the purposes of this EIA. In selection of the numbers and depth of charge, type of charge, etc., a

⁹⁸ BS 5228-2:2009 Code of practice for noise and vibration control on construction and open sites. Table B.2

reasonable level of conservative approach has been taken. Therefore, it is anticipated that actual level of PPV will be less than the level shown in Table 8-14.

508. The closest property to a tunnel portal is at the Tagikamar South Portal where the closest development is at least 200m from the portal. Therefore no adverse vibration impact from tunneling is anticipated. This does not absolve the Contractor from making their own calculation and adopting appropriate tunneling techniques to avoid any adverse impact on the local community.

7.3.8.3 Mitigation

509. The Contractor shall undertake a precondition survey along the alignment, as required under the contract, identify vibration sensitive sites and vulnerable buildings and identify the precautions to be adopted. These may include reduced pace of construction activity, low vibration plant and machinery and, as a last resort, at receptor mitigation e.g. insulation at affected SR / dwellings.
510. As good practice, a preconstruction survey should be jointly conducted by the Contractor and the Engineer to document the pre-construction condition of the structures, including all the defects and existing damages. Preconstruction surveys will also be required on the selected temporary access routes. Pre-construction surveys should have the following characteristics:
511. The surveys should be conducted in the presence of and with the permission of the property owners. The survey reports should also be verified by the property owners. Secondary purposes of the pre-construction surveys include answering any questions the building owner may have regarding the project and looking for anything that might require correcting before construction starts. Most building owners do not have experience with construction vibration, and may have concerns about their own safety and the safety of their structures.
512. Knowledgeable persons should attend to adequately answer questions. If the situation warrants, ad-hoc meetings should be held and a presentation made that explains the reason for the project, that construction will be necessary, what the residents can expect to hear and feel from the construction, any specific warning signals that will be used, and the intent of the pre-construction surveys.
513. For purpose of assessment the magnitude of impact both elements, the type of receptor (structural condition of the potentially affected building) and the type of machinery (emission source) need to be considered.
514. Based on the survey results, the Contractor shall identify vibration sensitive sites and vulnerable buildings and identify the precautions to be adopted. These may include reduced pace of construction activity, low vibration plant and machinery and, as a last resort, at receptor mitigation e.g. insulation at affected SR / dwellings.
515. The following mitigation measures will be implemented before the commencement of the construction phase⁹⁹.

The bidding documents for civil works will require that the Contractor submit to the Engineer for review and approval a written Construction Vibration Management Plan

⁹⁹ Extracted from the approved IEE for Dushanbe – Kurgonteppa Road Project (KOCKS 2018) Para 430

(CVMP) detailing the procedures for vibration monitoring and control. The CVMP plan will include the requirement for trial construction sections to determine the likely magnitude of vibrations at defined distances from a vibration source. These programs would be reviewed and approved by the Engineer to ensure compliance with contractual specifications, including the EMP. The maximum permissible vibration limit set at 0.25 inch/s must not be exceeded within the defined contour (7.5m from the road edge) where houses may be at potential risk of damage (as defined by the condition surveys).

Where the results of the vibration monitoring, or from a trial construction section, show that the specified construction vibration limit is reached at a particular location, the Contractor would be directed by the Engineer to suspend the construction activities that generate the excessive vibration at such location, and with the approval of the Engineer take mitigative actions necessary to keep the construction vibration within the specified limit.

Such actions may include, alternative construction methods such as: (i) decrease of vibration emission from the particular equipment item; (ii) substitution of the particular equipment item at such location by other equipment capable of variable vibration control; (iii) use of smaller equipment; (iv) compaction without vibration rollers; (v) decreasing the thickness of material layers below the maximum thickness permissible under the specification; (vi) building wave barriers (trench or ditch) where appropriate; (vii) change the pavement type for example from flexible to rigid pavement, (viii) any other method of Contractor's choice that may be used while ensuring compliance with the specification for the material that is being compacted.

516. Once work in a particular section of the road has been scheduled, nearby residents and property owners should be notified about the specific times and dates that vibration generating activity will occur.

517. The general requirements for vibration mitigation are identified in the EMP section of this EIA. The precise mechanisms will be identified in the SEMP, but will include the following management plans:

- Noise and Vibration Management Plan (NVMP)
- Traffic Management Plan (TMP)
- Blasting Management Plan

518. Additionally, location specific noise mitigation measures will be covered by the required plans for these operations, including:

- Camp Management Plan
- Concrete and Asphalt Production Management Plans
- Construction plans and Method Statements
- Method Statements for Temporary Activities

519. With mitigation in place the post mitigation risk is assessed as “low”, and the effect is not considered significant..

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Construction vibration and damage to buildings / structures	MINOR	IMPROBABLE	LOW	NO

7.3.9 Construction Air Quality – Dust and Other Air Emissions

7.3.9.1 Impacts

520. Adverse air quality impacts can occur due to: emission of inorganic dust from digging /loading works; emission of harmful substances; dust from combustion of diesel used by transportation vehicles and manufacturing machinery (crushers / asphalt/ concrete batching plants); as well as smoke arising from road construction works during asphalt works. Welding works cause welding aerosol and manganese monoxide emissions.

521. Concrete work for bridges can result in cement dust emissions. If mobile asphalt plants are used, they could cause negative impact on surface water, groundwater and air quality, if not properly managed. For this reason, mobile asphalt plant should be avoided, and static plants used instead, where feasible. All asphalt plants should be certified and inspected according to Tajikistan norms before they are allowed to be used for the works. Dust arising from construction works will have negative impact on the ambient air quality, and it is necessary to take effective protective measures to minimize the negative impact, especially near settlements

522. During construction, air pollution in the form of dust from earthworks and vehicle emissions will increase. Deterioration of air quality during pre-construction and construction works can be due to the following:

- Dust emissions during earthwork and from stockpiles;
- Dust from loading, transportation and unloading of soil and other friable materials;
- Dust from the demolition of the houses subject to acquisition;
- Emissions from operation of construction machinery, asphalt plant, concrete batching plant, etc.;
- Dust and emissions from onsite and offsite traffic, vehicles moving across unpaved or dusty surfaces.

523. Dust is a problem for a variety of reasons, including:

- Inconvenience to local people, including re-wash of laundry put outdoors to dry, re-wash of windows, curtains and vehicles. Dust can contaminate food left in the open air in homes and shops and be ingested during meals.
- Health and safety. Dust may affect health by irritating eyes and worsening the health of people with bronchial conditions (e.g. asthma). Dust can reduce visibility for drivers on roads, creating a road safety issue.
- Crop damage. Even low concentrations of dust can affect plant and fruit growth. Plant growth is particularly susceptible to dusts that are highly alkaline, for example limestone and cement dust. Dust deposited during light rainfall can cause the soil surface to form a crust increasing run-off.

- Impact on ecology. Dust blowing onto watercourses may damage ecology by increasing sedimentation, reducing sunlight and suffocating marine fauna. It may also affect plant growth and change the species of plants growing in an area.
 - Impacts to businesses. Bee keeping and selling local produce are noted as an economic activity within the Project area.
 - Damage to plant and equipment. Within the construction site, dust can cause mechanical or electrical problems in sensitive equipment, such as computers. It can also increase abrasion of moving parts in equipment and clogging of air filters.
524. The amounts of vehicle-emitted pollutants will depend on the technical condition of the Contractors vehicles, fuel quality and travel speed. Older vehicles usually have lower fuel consumption efficiency and cause higher emissions of combustion by-products. Increasing speed of the vehicle demands higher fuel supply and therefore results in larger amounts of emitted pollutants. The contractor should pay attention to the age and status of technical maintenance of vehicles/machinery used during construction. Where feasible, preference could be given to electric powered equipment.
525. There are no substantial industrial sources of air pollution in the area and there is currently very little traffic along the existing alignment.
526. The scale of dust and exhaust emissions related impacts will depend on the prevailing wind direction in the Project area, traffic speed and the status of technical maintenance of the vehicles/machinery and organization of works.
527. The location of the construction camp and laydown sites (including topsoil, spoil disposal areas) is not confirmed. The location, layout and technical parameters of the camp will be defined by the Contractor in a Camp Management Plan. Several areas have been proposed by the Design team for spoil disposal. The final locations of the temporary (camp, laydown areas) and permanent (spoil disposal) sites will be identified and specified by the Contractor with consideration of the recommendations provided in this EIA, including development and implementation of all plans and sub-plans required by the EMP. Locations will be agreed and approved by MoT. The location of the spoil disposal sites is subject to a separate approval procedure.
528. There are areas of residential development along the alignment. At these points an adverse air quality impact from construction activity can be expected. For this reason the consequence of construction air quality impact is considered to be “medium” and the likelihood of impact “probable”, in the absence of mitigation. Adverse impact is therefore expected and will require management by the contractor in the form of an air quality (emissions and dust) management plan included in their SEMP and identified in the EMP / contract for contractor implementation.

7.3.9.2 Mitigation

529. Dust-suppression measures aimed at prevention of air pollution will include watering of construction access roads, site roads and construction sites. Regular water sprinkling and enforcement of reasonable vehicle speeds during construction will alleviate dust impacts. The capacity of available water supplies along the alignment will need to be checked to confirm sufficient water is available for

watering, and that existing supplies used by the villages will not be adversely affected. It will also need to comply with the measures in the Water Management Plan. Dust at construction sites will be minimised by using closed / covered trucks for transportation of construction materials (especially loose construction materials such as gravel, sand, soil, etc.) and debris.

530. Other measures planned to maintain good air quality include locating asphalt plants, crushing plants, concrete mixing sites and stockpiles at least 1 km from sensitive receptors, as well as confining working vehicles to designated routes away from sensitive receptors. Stockpiles will be covered or dampened if local conditions (e.g. strong winds) give rise to significant dust emissions. All plant will be maintained in good working order, including any dust suppression / collection equipment (filters, etc.) that is fitted.
531. Prior to commencement of works likely emissions from crushers, concrete production facilities and other emissions generating facilities must be determined and agreed with the MoT.
532. The Contractor will develop an Air Quality Management Plan. The plan shall provide details of mitigation measures, specific location, and schedule where such measures shall be implemented. This is required to minimise impacts to sensitive receptors due to: the presence of the camp, construction works, sourcing and transport of construction materials, and other project-related activities. Recommendations provided in this EIA should be included in the plan.
533. The general requirements for air quality mitigation are identified in the EMP section of this EIA. The precise mechanisms will be identified in the SEMP, but will include the following management plans:
- Air Quality Management Plan
 - Waste and Materials Management Plan
 - Traffic Management Plan (TMP)
 - Blasting Management Plan
534. Additionally, location specific mitigation measures will be covered by the required plans for these operations, including:
- Camp Management Plan
 - Concrete and Asphalt Production Management Plans
 - Construction Plans and Method Statements
 - Method Statements for Temporary Activities
 - Bridge Construction Plan
 - Tunnel Construction Plan
535. These method statements will include sections relating to the management of air quality, including dust control. The method statements shall be reviewed by the Contractors Environmental Officer before submittal to the Supervising Engineer for review and approval. All method statements must be prepared and approved before any works can start in the planned areas. The method statements shall also include a record of consultations undertaken with all neighbouring land users and road users including their agreements for the use of these areas, roads.

536. The post mitigation risk is assessed as “low”, and the effect is not considered significant.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Dust and other emissions to air	MINOR	IMPROBABLE	LOW	NO

7.3.10 Hydrology and Water Quality

7.3.10.1 Impacts

537. Water will be required for construction activities, including water required for:

- Construction (e.g. concrete mixing);
- Dust suppression;
- Cleaning equipment;
- Potable water for construction workers; and
- Use in construction camps

538. If water resources are not managed appropriately by Contractors during construction, there is potential for depletion of the resource and adverse impacts on water availability for the local community, including for potable supply, domestic uses, agricultural irrigation, stock watering, etc.

539. Water resources are at risk of contamination during construction, due to accidental spillage of construction liquids and materials, from activities (e.g. refuelling), poorly maintained mechanical plant or poor storage of liquids.

540. There is also the risk of deposition of airborne contaminants, and other containants being mobilised in surface water runoff, and being washed into watercourses, with adverse effects on downstream communities and aquatic ecology.

541. There is a potential risk of contamination due to sewage treatment facilities at construction camps. This risk will be managed by either treating the sewage to the required standards, prior to discharge of treated wastewater to surface watercourses, or the collection of sewage in septic tanks, and its disposal by licenced sewage disposal companies. This will require appropriate management and monitoring to ensure that discharges are within acceptable levels, based on permit requirements and Tajik / international standards.

542. There is a risk that the construction activities could result in the pollution of watercourses that may be used by the community, and have adverse impacts on stream ecology, if not appropriately managed.. This will require management by the contractor.

7.3.10.2 Mitigation

543. The Contractor will prepare a Water Resources Management Plan, that must provide details on predicted waste water (sewage) volumes, disposal scheme, information on capacity and type of waste water treatment facility, location of the discharge point/points with indication of coordinates. A discharge permit will be sought from the CEP and Maximum Allowable Discharge Limits (MADLs) will be set

which the project must then comply with. The plan should include measures to minimise water usage in the first instance, and also opportunities for reuse of water where possible.

544. The Contractor will undertake a capacity study of available water resources along the alignment, including the location and quality of water resources used by the villages, to identify the capacity of resources. The Contractor must assess the availability and current usage of current supplies, to avoid any impact on the availability of resource to communities and businesses along the alignment. If existing groundwater or surface water resources are not appropriate (quantity or quality), alternative sources of water will be identified by the Contractor, to ensure the available resources used by the local communities are maintained at all times. The Contractor will liaise with the community to understand seasonal water demand constraints, and periods of high water volumes / increased erosion.
545. Water abstraction should also be designed in accordance with the requirements of the Biodiversity Management Plan to minimise impacts to habitats reliant upon surface and ground water.
546. The potential pollution impacts will be mitigated through the implementation of good site practices by the contractor, and checked during regular audits by the supervising engineer. This will include: material storage and spill prevention measures set out in the Water Resources Management Plan and Emergency Response Plan, respectively,
547. All camp sewage treatment plants must be managed in accordance with manufacturer's instructions by competent personnel, and discharges regularly monitored. If discharges cannot be treated to an acceptable standard, liquid wastes must be removed by an authorised company and disposed in an environmentally responsible manner in accordance with the Waste and Materials Management Plan.
548. The potential risk of construction activities resulting in increased flood risk, of being adversely affected by flooding will be managed through measures set out in the Water Resources Management Plan.
549. This will require management by the contractor in the form of a management plan in their SEMP and needs to be incorporated into EMP / contract for contractor implementation. Provided these mitigation measures are adopted by the contractor in the SEMP, the impacts can be reduced to an acceptable level. The precise mechanisms will be identified in the SEMP, but Contractors will be required to develop and implement the following management plans, which will be approved and monitored during construction by the PIURR and Supervising Engineer:
- Water Resources Management Plan, including:
 - Ground Water Management
 - Waste Water Management
 - Emergency Response Plan, including:
 - Spill Management Plan
 - Waste and Materials Management Plan

550. Additionally, location specific mitigation measures will be covered by the required plans for these operations, including:

- Camp Management Plan
- Concrete and Asphalt Production Management Plans
- Construction Plans and Method Statements
- Method Statements for Temporary Activities

551. The post mitigation risk is assessed as “low” , and the effect is not considered significant

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Adverse impacts on water quality and quantity, and flood risk, due to construction activities	MINOR	POSSIBLE	LOW	NO

7.3.11 Biodiversity

7.3.11.1 Impacts

552. The potential impact of the project on biodiversity is relatively low, due to the road being developed within an already disturbed alignment, and situated within a degraded environment that has been subject to anthropogenic pressures for many years (in particular livestock grazing). Ecosystems have been substantially transformed since the previous construction activities were undertaken in the Soviet era, and already carry a significant anthropogenic footprint.

553. During construction, the main impacts will comprise direct habitat loss in the immediate vicinity of the project alignment, within the construction working areas adjacent to the alignment, and the locations of new tunnelling. There will also be disturbance associated with construction activities, mainly noise and vibration impacts.

554. Habitat loss will generally impact areas of relatively low biodiversity value (i.e. as is present on the existing alignment, or adjacent grazed areas).. The greatest impact will occur where individual stands/areas of increased biodiversity interest, most notably any remnant ancient fruit trees, Red Book plant species, and native woodland, are situated within the construction footprint. At present it is not considered that the scale of this impact will trigger any significant effects upon biodiversity; however, mitigation will be implemented to further ensure this.

555. Disturbance impacts will affect fauna making use of features for sheltering purposes, foraging, or undertaking other activities, within disturbance distance of the construction activities. Most notably this will include roosting bats, nesting birds and hibernating/sheltering reptiles and amphibians, all of which are sensitive to such disturbance while using these features. It is possible that some of this fauna will include Red Book species, although most likely at very low levels, due to the high levels of disturbance that are already present. Mitigation will be implemented to prevent any significant effects as a result of this impact.

556. Construction impacts will comprise increased risk of wildlife road traffic accidents with construction vehicles, and increased pressure from hunting and collecting of fruit / seeds / medicinal herbs due to the influx of construction workers.
557. Road traffic accidents will affect all fauna, but have the potential to affect Red Book (and otherwise rare) large carnivores such as snow leopard, wolf and brown bear, which will occasionally roam across the project area for foraging purposes (i.e. especially when snow levels at higher altitudes make foraging there difficult). Given the level of presence of such species, together with the traffic volumes and prevailing speeds, it's considered unlikely that a significant effect will result. However, this will be prevented through measures in the Traffic Management Plan and Code of Conduct.

7.3.11.2 Mitigation

558. The project's potential impact on biodiversity is considered to be limited, however, mitigation measures should be adopted to ensure this. These are detailed within the project EMP; in summary, these comprise the following:

- Walkover survey of full route to explicitly identify features/species/areas of particular conservation interest (i.e. ancient fruit trees, native woodland stands, suitable bat roost/bird nest features, Red Book plants, etc.).
- Implementation of the Biodiversity Management Plan (BMP), that will document the findings from the walkover survey, and detail measures to be adopted to protect these features.
- Timing of works to avoid most sensitive windows for sheltering species. Where this is not possible, pre-construction checks of features immediately in advance of works, and subsequent fencing and exclusion of workers and construction activities, from area where these features are present, during construction until naturally no longer in use.
- Programme of education/awareness-raising of workforce to prevent hunting/poaching/collecting of rare seeds, etc.
- Monitoring of construction wildlife road traffic accidents, and concurrent liaison with state forest authorities to inform changes to supplementary feeding should large carnivores be at risk of continued impacts in this regard.
- Sympathetic restoration of temporary construction areas – i.e. comprising re-planting of native plant species of increased biodiversity value (as informed through consultation with local experts).

559. With mitigation in place, the residual effect to biodiversity is considered to be not significant.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Adverse impacts on Biodiversity, flora and fauna, due to construction activities and illegal poaching /gathering.	MINOR	IMPROBABLE	LOW	NO

7.3.12 Historic-Cultural and Archaeological Monuments

7.3.12.1 Impacts

560. No archaeological or cultural resources are expected to be encountered during project implementation, since no findings have been reported and the majority of the works are on a corridor where excavations have been conducted before, so any resources that may have been present are likely to have been damaged by the previous works, and be in a poor state of preservation..

561. An enquiry regarding cultural heritage locations in the project area was made to the Academy of Sciences of the Republic of Tajikistan – Institute of History of Archaeology and Ethnography in June 2019. The response was that that *“there are no historical and archaeological monuments in the area where the route is laid”*.

562. During the consultations carried out for the LARP, no cultural heritage sites were identified as being affected by the alignment works. However, there are mosques in the villages that are of local cultural value, and the measures that will be undertaken to reduce the risk of adverse impacts on residential buildings, will also be applied to the mosques.

7.3.12.2 Mitigation

563. A chance find procedure will be implemented during construction. In the case of discovery of buried archaeology during construction activities, the works shall be immediately stopped and the relevant authority is to be informed. Works will proceed following discussion and guidance obtained from the Ministry of Culture or their respective subordinate or regional unit.

564. The need for a Contractor chance find procedure is included in the EMP for this EIA and the Contractor will include their procedure in the Cultural Heritage Management Plan.

565. The post mitigation risk is assessed as “low”, and the effect is not considered significant

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Impacts on historic cultural and archaeological monuments	INSIGNIFICANT	IMPROBABLE	LOW	NO

7.3.13 Waste and Materials

7.3.13.1 Impacts

566. The construction phase of the project will generate wastes including the following anticipated waste streams:

- Demolition debris (brick, asphalt, concrete, etc.) will be generated during the rehabilitation / construction works on road and associated infrastructure.
- Tunnelling spoil and excavated subsoil;
- Green waste will be generated during site clearance;

- Waste water treatment sludges from operation of camp sewage treatment plants. If wastewater from these plants does not meet acceptable discharge standards, this may also become classified as a waste;
- Hazardous wastes, including oils, lubricants, oil filters, absorbents and rags, paints / solvents, and batteries.
- Asbestos containing materials, from demolition activities (pipes and roofing materials) and vehicle brakes;
- Soil polluted with petroleum hydrocarbons from fuel / oil spills or leaks;
- Tyres;
- Scrap metal;
- Potentially recyclable materials (cardboard, plastics, etc.); and
- Mixed municipal wastes from construction camps and worksites.

567. The estimated quantity / volume of the key waste streams, based on experience from similar projects, is presented in Table 48¹⁰⁰.

Table 48: Description of Construction Waste Material, Approximate Volumes of Waste

	Waste Material	Description	Approximate quantity	Characteristics
1	Waste paints that may contain organic solvents or other hazardous substances	liquid	1,650 -2,000 kg	H3B – ignitable; H5 – harmful
2	Oils and oily lubricants	liquid	120-150 kg	
3	Absorbents, overalls and rugs, contaminated with hazardous matter	Solid	50-70 kg	
4	Waste tyres	Solid	3,000 -3,500 kg	-
5	Oil filters	Solid	20-25 kg	H5 – harmful
6	Brakes and other materials that contain asbestos ¹⁰¹	Solid	50- 70 kg	H7 - Carcinogens
7	Lead containing batteries	Solid	360-450 kg	H6 - Toxic
8	Metals (various)	Solid	500- 1,000 kg	-
9	Mixed municipal waste	Solid	225 kg	-

568. The amount of domestic waste will depend on the number of the staff (a staff level of 500 at each camp has been identified in this EIA based on information from other road projects in Central Asia). Assuming that the quantity of domestic waste generated per capita per year totals 0.7 m³, the approximate total amount of domestic refuse produced during construction will equate 500 x 0.7=350 m³/year for each camp.

¹⁰⁰ EIA for the Kvasheti-Kobi Road, Roads Department of Georgia by ANAS INTERNATIONAL ENTERPRISE, GPINGENIERIA, IRD Engineering, October 2018 Table 126

¹⁰¹ Asbestos containing brakes and construction materials should be avoided on site

569. Poorly managed solid and / or liquid waste can result in contamination impacts on the water environment and soil, leading to impact on flora and fauna and health risks to local residents.

570. The scheme will require materials to create the new infrastructure including carriageways. This may include the use of primary materials, for example aggregates, or secondary recycled materials e.g. recycled concrete sourced on site, or recycled materials brought in from off site, produced by another nearby construction project. The project will require concrete, iron and steel for the bridges and tunnels, and stone, asphalt and soil for the road and adjacent landscaping

7.3.13.2 Mitigation

571. The Contractor will prepare a Waste and Materials Management Plan to ensure the impact of waste disposal and the use of materials is reduced to an acceptable level. The precise mechanisms will be identified in the SEMP, but Contractors will be required to develop and implement the following management plans, which will be approved and monitored during construction by the PIURR and Supervising Engineer:

- Waste and Materials Management Plan
- Water Resources Management Plan, including:
 - Ground Water Management
 - Waste Water Management

572. Additionally, location specific mitigation measures will be covered by the required plans for these operations, including:

- Camp Management Plan
- Concrete and Asphalt Production Management Plans
- Construction plans and Method Statements
- Method Statements for Temporary Activities

573. The Waste and Materials Management Plan requires the adherence to the waste hierarchy¹⁰² to prevent or reduce the generation of waste where possible, and then to reuse / recycle wastes where possible, in preference to disposal.

574. Agreements / contracts will be signed and maintained with the appropriate authority authorised company to ensure timely transportation and disposal of waste. Contractors will be responsible for maintaining these contracts and ensuring that all wastes are disposed in an environmentally responsible manner in accordance with the Waste and Materials Management Plan and Tajik regulations. The Contractor shall audit waste disposal companies used to dispose of wastes from the Project.

575. The Camp Management Plan sets out measures to manage camp sewage, and domestic waste.

¹⁰² Waste prevention→Reuse→Recycling→Other recovery→Disposal

576. Tunnelling spoil, excavated subsoil and demolition wastes will be reused as construction material in the Project, or during post-construction maintenance, where possible. Such materials will be returned to construction locations or MoT depots for reuse. The reuse of materials will reduce the need to extract new materials from borrow pits.
577. Tunnelling spoil and excavated subsoil, that is not used as fill material, will be disposed to agreed spoil disposal areas, that have been approved by MoT. The Design consultant has proposed potential spoil locations sites which are discussed in Section XX. The Contractor may choose to use these locations, or alternative locations provided they obtain the appropriate approvals. To ensure that these locations are suitable from an environmental and social perspective a Spoil Disposal Plan must be prepared by the Contractor as part of the SEMP and submitted to the Supervising Engineer for review and approval by MoT before any site can be used. The Contractor will be required to prepare an EIA for any spoil disposal site to meet national requirements.
578. There are no waste disposal facilities for hazardous wastes present in the project area, and there is limited provision for the management of hazardous waste disposal in Tajikistan, so this category of waste must be handed over to an authorised contractor for disposal. Any hazardous waste agreement with a company authorised for treatment (deactivation, incineration) or re-use in other technological processes must be signed and made available to the Engineer for approval. Treatment, utilisation, disposal of waste shall be carried out only by authorised contractors. The area allocated for temporary storage of hazardous waste shall have special preventive measures implemented, in particular, containers shall have secondary containment and no mixing of hazardous waste with any other waste shall be allowed. Hazardous waste containers shall be checked for tightness. The staff involved in hazardous waste management shall be trained in waste management and safety issues.
579. If there are no suitable disposal options available for hazardous waste, then there may be a need to manage this waste on-site, though interment in lined pits . However, this is not a recommended option and would only be used if all other options were unfeasible. In this case, any proposed location will require adequate environmental assessment, design and management.
580. While the waste impacts could be considered undesirable the risk severity is considered to be “moderate” and the likelihood of the event happening “possible” The Risk matrix suggests a Risk level of “medium” – needs to be incorporated into EMP / contract for contractor implementation.
581. The post mitigation risk is assessed as “low”, and the effect is not considered significant.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
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Impacts due to the use of materials or the disposal of construction waste	MINOR	IMPROBABLE	LOW	NO
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7.3.14 Socio-Economic –Labour Conditions

7.3.14.1 Impacts

582. The construction of the project will create jobs for an influx of construction workers. The workers will be employed by the main Contractors who will be instructed by the PIURR on each Package.
583. A lack of appropriate HR policies and procedures could lead to workers being unfairly treated and dismissed, which could lead to workers loss of income, livelihood and potentially poverty.
584. The construction workers may have adverse impacts on the local community, though negative interactions, and illegal poaching / gathering of fruit, medicinal herbs etc.

7.3.14.2 Mitigation

585. The precise mechanisms for the management of labour conditions will be identified in the SEMP, but Contractors will be required to develop and implement the following management plans, which will be approved and monitored during construction by the PIURR and Supervising Engineer:
- Labour and Working Conditions Management Plan
 - Local Employment and Procurement Plan (LEPP)
 - Social Risk Register
 - Code of Conduct (CoC)
 - Grievance Redress Mechanisms (GRM)
 - Camp Management Plan
586. Additionally, a Project Stakeholder Engagement Plan (SEP) will be implemented via a Contractor SEP.
587. The Contractor will be responsible for ensuring that worker's working conditions and those adopted by their sub-contractors (including working terms, wages, equal opportunities, benefits, GRM, accommodation provision, etc) comply with Tajikistan and IFI requirements.
588. The Contractor will be required to prepare a code of conduct that enshrines the commitment of the project to meet employment and labour standards. Environmental and social protection and anti-bribery and corruption controls. Requirements and training to manage the behaviour of construction workers. HR policies and procedures will be developed and implemented as required under the EMP.
589. The post mitigation risk is assessed as "medium" and the effect is considered to be not significant, following the implementation of the proposed ongoing mitigation.

RISK	RISK SEVERITY	RISK LIKELIHOOD	RISK LEVEL	SIGNIFICANT?
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Inadequate labour conditions	MODERATE	POSSIBLE	MEDIUM	NO
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7.3.15 Socio-Economic – Workplace and Community Health and Safety

7.3.15.1 Impacts

590. Construction activities are inherently hazardous, due to the activities they involve, and the constantly changing nature of operations, work locations and site conditions. The large size of the work sites on road construction projects present an additional risk factor. Risks to safety can occur due to violation of proper health and safety practices and may lead to injuries and accidents.

591. Risks from construction activities apply to both to Project personnel and the community in the areas near the Project.

592. Hazards associated with construction activities include:

- Construction traffic and mobile work equipment;
- Lifting operations;
- Interaction between vehicles and pedestrians;
- Deep excavations;
- Temporary works;
- Work at height, particularly on temporary access structures;
- Exposure to noise, dust, vibrations and other hazardous agents;
- Hazardous materials, including fuels and bitumen;
- Exposure to heat, cold and extreme weather conditions;
- Work in confined spaces;
- Use and storage of explosives (for tunnels);
- Collapse of tunnels and other structures;
- Electrical and other equipment; and
- Unauthorised access – a particular hazard in work sites with a large area.

593. Additionally, the remote location of the work sites presents an additional risk factor, as assistance would take longer to arrive in the event of a medical or other emergency. The restricted institutional capacity, and limited equipment available, at existing emergency services, is a further risk.

594. The project may result in impacts on the health and safety of the community as a result of: noise, dust and other emissions from earthmoving, blasting, piling, and operation of equipment and vehicles.

595. Failure to implement robust safety procedures and develop a positive safety culture could lead to injury and illness and therefore health and safety will require robust management by though the Contractor though the measures in the Health and Safety Management Plan.

7.3.15.2 Mitigation

596. Safety impacts will require management by the contractor in the form of a management plan in their SEMP and needs to be incorporated into EMP / contract for contractor implementation. The precise mechanisms will be identified in the SEMP, but Contractors will be required to develop and implement the following

management plans, which will be approved and monitored during construction by the PIURR and Supervising Engineer:

- Health and Safety Plan, including:
 - Specific measures for the construction of bridges and tunnels
- Emergency Response Plan, including:
 - Natural Disaster Response Plan
 - Spill Management Plan

597. Additionally, location specific mitigation measures will be covered by the required plans for these operations, including:

- Camp Management Plan
- Concrete and Asphalt Production Management Plans
- Construction Plans and Method Statements
- Method Statements for Temporary Activities

598. Implementation will be enforced by suitable qualified H&S personnel and by robust monitoring of the required measures. On site support from an international consultant specialising in health and safety, providing additional technical support and advice, and building the capacity of the Contractor will be engaged. The consultants will assist the Contractors in developing, implementing and monitoring the Health and Safety Plan.

599. The Emergency Response Plan will include measures and resources for prevention, mitigation and response to all foreseeable emergency scenarios (road traffic accidents, spills, fire, etc.) associated with construction activities, and should consider the suitable response resources (medical, fire fighting, etc) for all related foreseeable emergencies, which are necessary to mitigate the remote location of the work sites and consequent increased response times. It likely to be necessary to provide equipment and facilities within the construction camps.

600. With the management plans and mitigation in place risk is assessed as “high” and the effect is considered significant, following the implementation of the proposed ongoing mitigation. For this reason, particular focus will be placed on monitoring of the risks and ensuring that mitigation measures are rigorously applied throughout construction.

RISK	RISK SEVERITY	RISK LIKELIHOOD	RISK LEVEL	SIGNIFICANT?
Inadequate safety controls and risks to workers and the community	MAJOR	POSSIBLE	LOW	NO

7.3.16 Socio-Economic – Utilities and Infrastructure

7.3.16.1 Impacts

601. There is limited utility provision except at the villages at Kandak at the west end of the alignment where there is: water, gas and electric utility pipework and cabling. There are no fibre optic cables, wastewater pipes, irrigation systems, storm water sewers, pedestrian crossings or passes for cattle and agricultural machinery, etc.

602. The villagers along the alignment generally harvest water from locations upslope from the alignment, it is then transferred by ditches and pipework to individual houses downslope from the alignment.
603. The construction of the road has the potential to interrupt access to water and utilities, due to planned service interruptions, blockage of access routes to the services, or due to accidental damage caused by construction activities (particularly excavation works).

7.3.16.2 Mitigation

604. Safe access to utilities should be provided throughout construction. The early construction of culverts or pipework, installed beneath the road, near these sources of water may enable villagers to run water hoses through the pipes. This will ensure that local villagers will not need to cross the road, or construction working areas, to access water.
605. Measures to prevent damage to buried or above ground utilities will be included in the Worker and Community Health and Safety Plan.
606. . With mitigation in place the post mitigation risk is assessed as “medium”, and the effect is not considered significant.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Impacts on utilities and infrastructure	MODERATE	POSSIBLE	MEDIUM	NO

7.3.17 Socio-Economic – Resettlement, Land Acquisition, Economic Displacement

7.3.17.1 Impacts

607. The design philosophy has been to avoid or, at least, minimise, project-induced resettlement. However, based on the final design and decisions to be made with respect to bringing the existing road up to necessary national standards, some land acquisition and resettlement will be necessary.

7.3.17.2 Mitigation

608. The Project is the subject of a detailed Land Acquisition and Resettlement Plan (LARP) for each Package and the reader is referred to the Package 1 LARP (December 2018) which will be disclosed on the ADB website, and the Package 2 LARP (July 2019) for which will be disclosed on the EBRD website and the MoT website.
609. Potential for physical and economic displacement associated with the construction of village access roads and construction site access roads, when selected, will also need to be assessed and managed via the same process as for the main alignment, and the LARP extended to include these additional features of the Project.
610. With implementation of the LARP and ongoing liaison with affected community members, the risk is assessed as “low” and the effect is not considered significant,

following the implementation of the proposed ongoing mitigation and management.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Impacts on population - Resettlement, / Land Acquisition and Economic Displacement	MAJOR	POSSIBLE	LOW	NO

7.3.18 Socio-Economic Impacts –Other Impacts

7.3.18.1 Impacts

611. The project is anticipated to have a number of positive impacts on population and economic development providing job opportunities for local men and women. In particular, the construction camps can have a beneficial impact on a local community providing the opportunity for employment for both local men and women. There is also the opportunity for the local business to sell their goods and services leading to increased household income and livelihood for the local AHs. However, these local opportunities will need to be encouraged during the procurement and construction processes.
612. The project will expose some village populations to traffic for the first time, and will raise safety issues for the residents close to the alignment. Additionally, there are impacts associated with dust, noise, water, landscape, etc. from construction as discussed in previous sections. There will be in-migration of construction workers into the Project-affected area, which can subsequently lead to increased health risk to the local community (i.e. the potential for transfer of communicable or infectious diseases, such as hepatitis, polio, influenza, HIV/AIDS, malaria, etc), crime levels, instances of alcoholism and drug use amongst others. This has the potential to result in increased impacts to women, including the possibility of gender based violence.

7.3.18.2 Mitigation

613. A Stakeholder Engagement Plan (SEP) has been developed for the Project and will be implemented throughout to ensure continual consultation is undertake during construction. A Community Liaison Officer (CLO) will be engaged to manage and implement the SEP. In addition, other initiatives will be carried out during the works to raise awareness of road safety and other aspects within the local community, particularly to the local women and children. Such initiatives have been identified within the Project EMP.
614. To mitigate the disturbance to the population, appropriate information on the project (including location and duration of construction works) shall be regularly provided to affected communities in accordance with the developed project-specific SEP. The local population should be appropriately informed about the commencement of construction works (information on construction activities should be available on the website of the Ministry of Transport, local authorities, and also through community newsletters, local TVs and from community leaders). Notification on commencement of construction works, limitation of vehicle

movement, alternative access and detour arrangements shall be provided to affected communities in advance.

615. The project shall have an established grievance redress mechanism that will allow affected parties to raise their concerns and obtain feedback, as specified in the SEMP.
616. The contractor will be required to develop a Local Employment Procurement Plan, the EMP (Chapter 8) outlines the measures to be taken to promote local procurement and employment.
617. The contractor will also implement a Gender Action Plan (GAP) which will describe affirmative measures to be taken to promote women in construction and gender-sensitive construction practices. The key actions are set the EMP (Chapter 8).
618. With implementation of the SEP and other public awareness raising and consultation, the risk is assessed as “Low” and the effect is considered not significant, following the implementation of the proposed ongoing mitigation and management.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Other non specific - Impacts on population	MAJOR	POSSIBLE	LOW	NO

7.3.19 Site Specific Impacts - Site Construction Access Routes.

7.3.19.1 Impacts

619. Two types of road providing access to the alignment will be developed. These are:

- Site construction access routes - these will be temporary access roads to the alignment for use by construction traffic during the construction period.
- Village access roads – these will be permanent access roads, connecting villages to the alignment.

620. Site construction access routes will be developed and used to access the alignment and construction camps from Road M41. They will also provide access to construction materials storage and waste disposal sites, asphalt and concrete plants, and storage facilities. These will be temporary access roads to the alignment for use by construction traffic during the construction period. The locations of temporary access routes have yet to be finalised, but anticipated routes are shown in Figure 12 and Figure 13.

621. The Contractor will select the construction access routes they wish to use, and will implement measures to ensure the roads are suitable for use by construction traffic, and are suitable from an environmental, social and safety perspective. These will be set out in the Construction Access Road Management Plan, which will include measures for the establishment, operation and timely reinstatement of the roads. Disruption to villagers along the construction access roads must be minimised at all times. The use of unmade roads can exacerbate soil erosion, and

degrade the landscape as well as generating localised traffic noise, vibration and air quality (dust) issues, and introducing traffic hazard to local communities. Additionally, roads in their current state may be unsuitable for passage of heavy vehicles (bank / bridge strength, width, limited space between buildings, etc.). The Plan will set out measures to manage these risks, and will require approval by the Supervising Engineer, approval by MoT, before any route can be used for construction access.

622. The village access road will be permanent roads that provide access from the villages along the new alignment to the new alignment. The locations of the village access roads has been determined, and these are shown in Figure 9 and Figure 10. The required standard that the roads will be built to is also set out in Figure 11.

7.3.19.2 Mitigation

623. A supplementary impact assessment of the proposed village access roads will be conducted as a supplement to this EIA. This assessment will include consultation with stakeholders, including regarding any proposed land acquisition.
624. With these mitigation measures the risk is assessed as “low” and is considered not significant significant, following the implementation of the proposed ongoing mitigation and management.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Impacts from the temporary construction and permanent village access roads	MINOR	POSSIBLE	LOW	NO

7.3.20 Site Specific Impacts - Construction camps

7.3.20.1 Impacts

625. The Contractor will be expected to source construction workers locally in the first instance. However, it is unlikely that the number of locally-skilled people in the area will be sufficient for the project, and additional construction workers will be employed outwith the area within Tajikistan, and further afield. This being the case, accommodation camps will be required.
626. Camps will contain offices and accommodation for works staff¹⁰³, maintenance areas and manufacturing areas crushing plant and asphalt and concrete batch plant and storage areas. Environmental impacts include noise from maintenance areas and any crushing plant, dusty works (from vehicle movements and operation of manufacturing equipment, rock crushers and concrete batching plant) and potential for adverse water impact due to runoff from unmade roads, oily runoff

¹⁰³ Based on experience of operating projects in Central Asia (Kyrgyzstan and Azerbaijan) it is anticipated that each construction contract could contain up to 400 staff (made up of management, international and local labour). Therefore camps of up to 400 persons should be planned for when considering water usage and waste generation and disposal.

from manufacturing and storage areas and sewerage discharges from poorly maintained septic tanks / waste water treatment facilities.

627. The in-migration of construction workers into the Project-affected area, can subsequently lead to increased health risk to the local community (i.e. the potential for transfer of communicable or infectious diseases, such as hepatitis, polio, influenza, HIV/AIDS, malaria, etc), crime levels , instances of alcoholism and drug use amongst others.
628. The risk of adverse effects to due to the location, development, operation and decommissioning of construction camps will be managed though the Contractor's implementation of a Camp Management Plan and Social, Community and Health Review, followed by the development and implementation of a Health Plan, incorporated in the Health and Safety Plan.

7.3.20.2 Mitigation

629. . Prior to start of site works, the Contractor shall develop a Camp Management Plan. The Camp Management Plan will cross reference other sub-plans including; Water Resources Management Plan, Spill Management Plan, Air Quality Management Plan, Noise and Vibration Management Plan, Waste and Materials Management Plan, and others as required.
630. . All camp sewage will be managed in accordance with the measures in the Water Resources Management Plan.
631. . The Contractor will be responsible for maintenance and clean-up of campsites and respecting the rights of local land users.
632. A Social, Community and Health review will be conducted by the PIURR, and must be approved by the Supervising Engineer. in order to develop a project-specific health plan that can be incorporated into the overarching Occupational and Community H&S Plan.
633. Camp activities will be included in the Emergency Response Plan, and suitable response resources (medical, fire fighting, etc) necessary to mitigate the remote location of the work sites and consequent increased response times. The construction camps will be staffed and equipped with a health clinic for all workers.
634. The Camp Management Plan will incorporate and reference the requirements of the Local Employment and Procurement Plan and Gender Action Plan.
635. With these mitigation measures the risk is assessed as "medium" and the effect is considered not significant, following the implementation fo the ongoing mitigation and management.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Site specific impacts – construction camps	MODERATE	POSSIBLE	MEDIUM	NO

7.3.21 Site Specific Impacts - Bridges

7.3.21.1 Impacts

636. In addition to the long bridge at the eastern edge of the project road, there are: ten bridges to be constructed along the alignment, and three bridges to be rehabilitated, as well as culverts along the alignment. Table 49 is a schedule of bridges recording the construction type, number of spans, work in river, etc.
637. These sites have the potential to result in adverse impacts on the rivers that they cross, due to construction material being deposited in the river during works within the river. The current construction design has avoided works within the watercourses, where possible. However, there is a requirement for works for columns and rip rap protection to reduce erosion effects in the watercourse at the bridge sites.
638. The watercourses across the project area are very dynamic, with the steep overall gradient in the region resulting in high discharge levels and constant movement of substrate through the system. They provide a water resource for local villages, but the value of their aquatic ecology is constrained by their dynamic nature.
639. Other impacts include general construction noise and dusty works (particularly as most bridge crossings occur in the major river valleys where village developments are concentrated), and potential for both silty and oily runoff.
640. Bridge construction works are hazardous if not conducted in a safe and controlled manner. In addition to the standard safety risks from construction, there are additional hazards created by work at height, and work over water. These risks will require controls to mitigate potential impacts to workers and the community, as set out in the Health and Safety Plan.

7.3.21.2 Mitigation

641. Much of the works will be precast, which will reduce the need for concrete batching near the bridge construction sites, and therefore potential for releases to watercourses.
642. Regardless of the relatively low sensitivity of the aquatic environment, it should be protected during construction through implementation of standard pollution prevention measures (including steps to prevent sedimentation of the watercourses. Prior to start of site works, the Contractor shall develop Construction Plans and Method Statements, including a Bridge Construction Plan, which will set out measures for the bridge works, detailing the specific controls to be implemented at each bridge location.
643. The method statements will cross reference other sub-plans including; Water Resources Management Plan, Emergency Response Plan, Safety Management Plan, Spill Management Plan, Air Quality Management Plan, Waste and Materials Management Plan, and others as required.
644. With these mitigation measures the risk is assessed as “medium” and the effect is considered not significant, following the implementation of ongoing mitigation and management.
- 645.

RISK	RISK SEVERITY	RISK LIKELIHOOD	RISK LEVEL	SIGNIFICANT?
Site specific impacts – bridge sites	MODERATE	POSSIBLE	MEDIUM	NO

Table 49: Schedule of Bridges and Characteristics

	No	Works	Chainage	Crossing	Spans (m)	Construction Method	Work in Watercourse	
Package 1	1	New	Km 77 +86.38	Kandak River	3 (24/34/24)	Composite concrete / steel	Yes, 2: each 12 piles 1 pile cap	Rip rap protection
	2	New	Km 130 +97.01	Gazaklyon River	4 (4x24)	PSC beams with concrete deck & asphalt cover	Yes, 3: each 12 piles 1 pile cap	Rip rap protection
	3	New	Km 135 +50.00	Zurion River	3 (15/24/15)	PSC beams with concrete deck & asphalt cover	Possible, 2: each 12 piles 1 pile cap	Rip rap protection
	4	New	Km 209 +10.14	Sebnok River	3 (34/33/32)	Composite concrete / steel	Possible, 2: each 12 piles 1 pile cap	Rip rap protection
	5	Rehab, new deck	Km 271 +05.57	Hakimi River	3 (15/24/15)	PSC beams with concrete deck & asphalt cover	Possible, 2: piers with flat foundation	Rip rap protection
	6	Rehab, new deck	Km 282 +62.00	Tagikamar River	3 (12/33/12)	Retain existing piers. New composite concrete / steel	1 pier	
	7	New	Km 331 +20	Chepak River	3 (24/32/24)	Composite concrete / steel	Possible, 2: piers with flat foundation	Rip rap protection
	8	New	Km 359 +99.54	Mudjiharf River	7 (24)	PSC beams with concrete deck & asphalt cover	Yes, 4 & 2 possible	Rip rap protection
Package 2	9	New	Km 492+55,50	Mirzosharifon River	5x32	Not available	Not available	
	10	Rehab, new deck	Km 523 +50.00	Dashtiguron River	24/426/24	2 x PCS, 1 PCB	Unlikely	Rip rap protection
	11	New	Km 565 +45	Tegermi River 1	1 PSC 24.5	PSC beams with concrete deck & asphalt cover	Yes, rip rap	Rip rap protection
	12	New	Km 571 +45	Tegermi River 2	1 PSC 33	PSC beams with concrete deck & asphalt cover	Yes, rip rap	Rip rap protection
	13	New	Km 679 +40	Kolot River	1 PSC 24	PSC beams with concrete deck & asphalt cover	Yes, rip rap	Rip rap protection

	Temporary			Surkhob River	2 or 3 tbc	Bailey or calendar hamilton (steel truss / framed)	1 or 2 piers	Removed when Br 14 completed
Package 3	14	New		Surkhob River	~750m long	Not known design and build from design brief	Design to be completed	

PCB = Precast concrete beam

CCS = Composite concrete steel

7.3.22 Site Specific Impacts – Tunnels.

7.3.22.1 Impacts

There are three tunnels on the alignment (two in Package 1 [Km11+ Kandak & Km21+ Karagach] and one in Package 2 [Km30+ Tagikamar). Although there was limited work in the Soviet era the tunnels are effectively “new construction”. The locations of the tunnels are shown in Figure 53 and a tunnel cross section is shown in Figure 52..

646. Environmental impacts from tunnelling operations include

- general construction noise at the portals during “mucking out” (removal of rock spoil) and vehicle movements (removing spoil),
- noise and vibration during the drill and blast work (though generally confined to the works developing the portal area),
- dust generation works (particularly portal emissions from extraction fans);
- potential for both silty and oily runoff; and
- Disturbance to fauna, particularly nesting birds and roosting bats, etc..from blasting noise and vibration.

647. Tunnel sites are generally remote from residential development and, therefore are unlikely to result in significant noise and dust impacts to sensitive receptors.

Figures showing developments within 500m and 1000m of each tunnel portal are presented in Figure 44 to Figure 51 and a summary of the receptors within 500m and 1000m is presented in Table 50

Table 50: Residential property within 500m and 1000m of tunnel portals

	South Portal		North Portal	
Tunnel	Within 500m	Within 1000m	Within 500m	Within 1000m
Kandak	Nil	Nil	Nil	21
Karagach	4	8	Nil	Nil
Tagikamar	6	>76	4	44

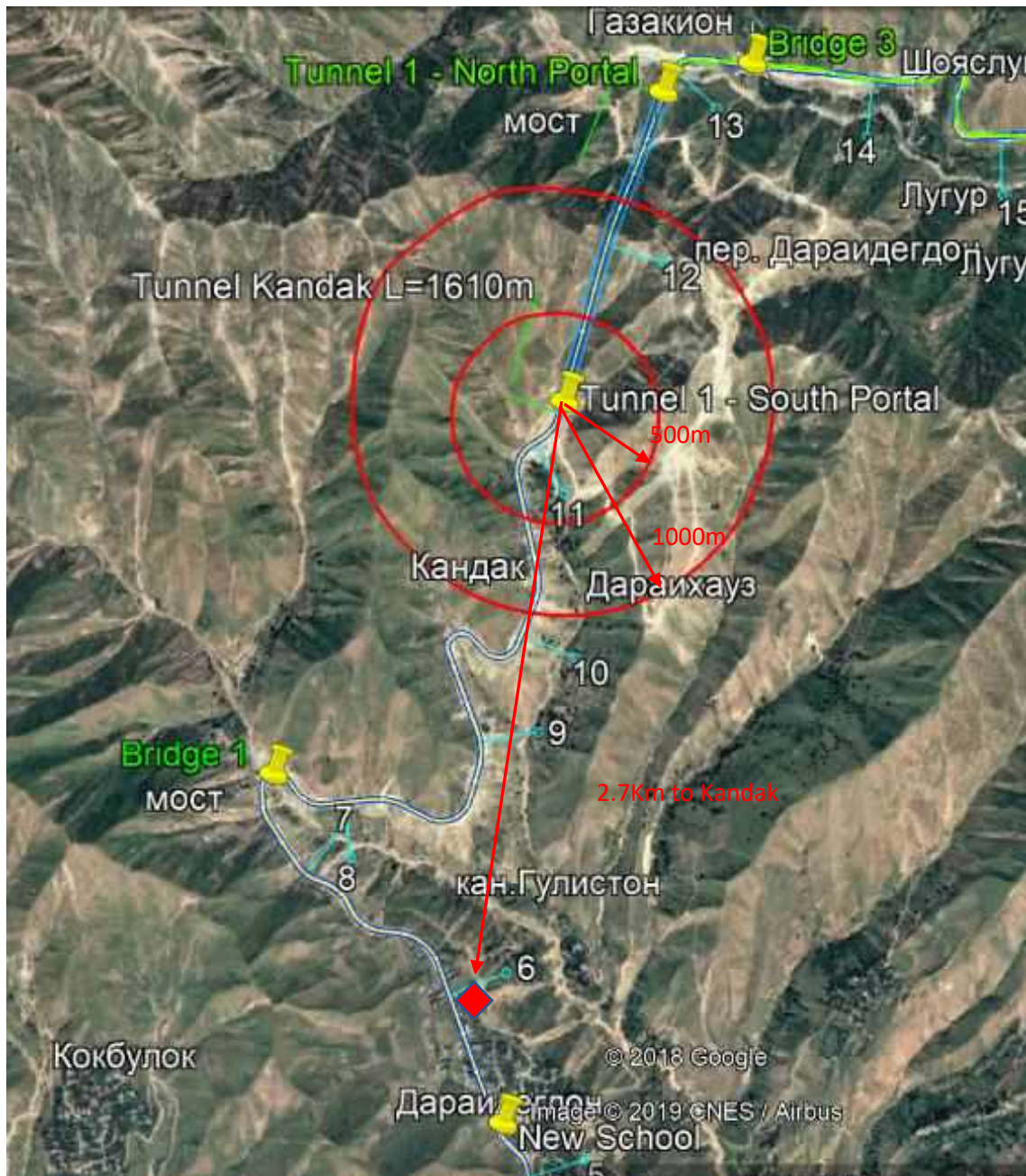


Figure 44: Residential property within 1000m of Kandak Tunnel South Portal

648. No permanent residential property within 1Km of Kandak Tunnel South Portal.
Closest permanent habitation in Kandak ~ 2.7Km from portal.

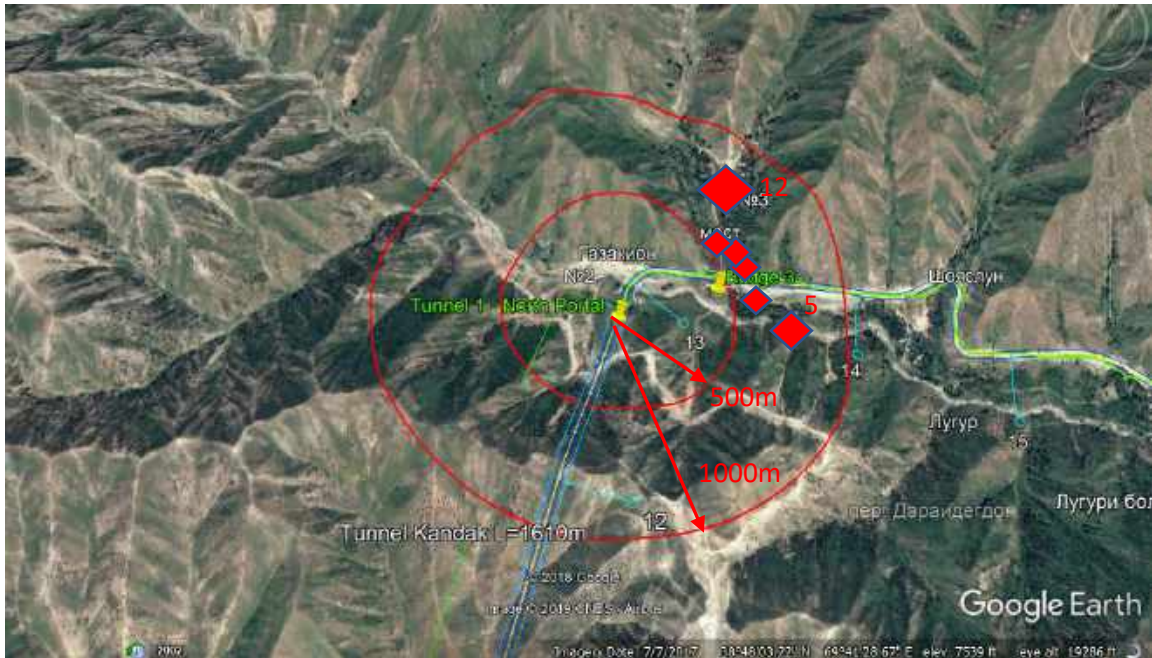


Figure 45: Residential property > 500m and <1000m of Kandak Tunnel North Portal

649. There are no permanent residences within 500m of the Kandak Tunnel north portal but there are 21 residences within 1Km of the tunnel portal



Figure 46: Residential property within 500 and 1000m of Karagach Tunnel South Portal

650. There are 4 residences within 500m of Karagach Tunnel South portal and 8 residences within 1Km of tunnel portal

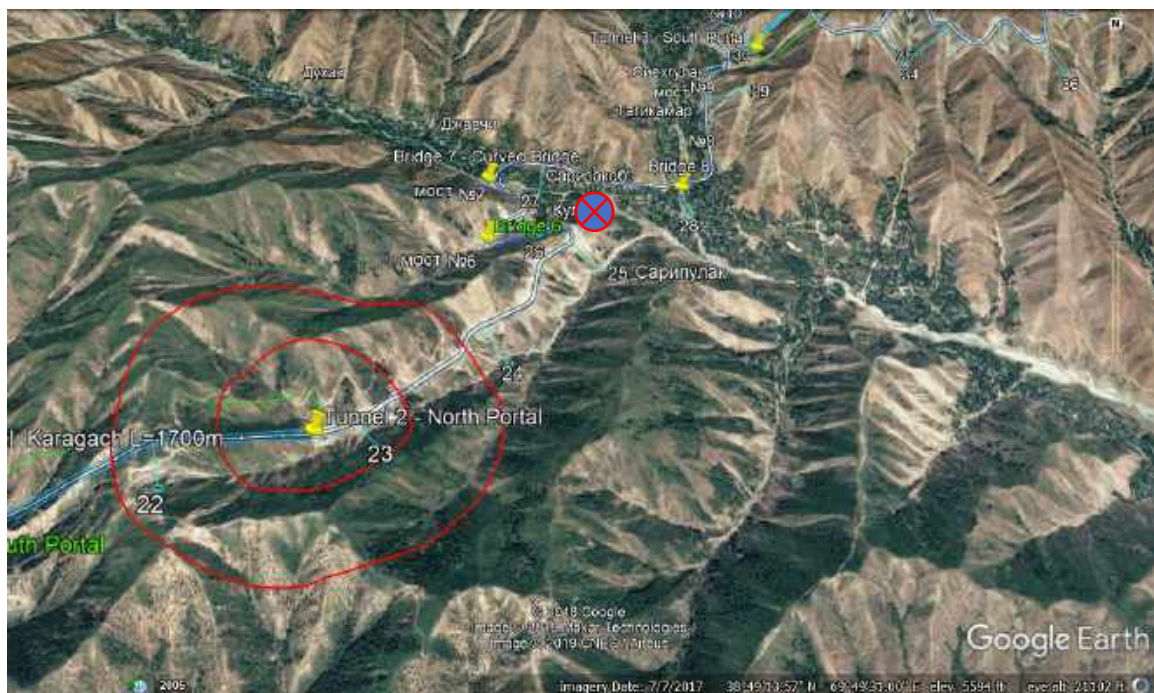


Figure 47: Residential property within 1000m of Karagach Tunnel North Portal

651. There are no permanent residential property within 1Km of the Karagach Tunnel North Portal. The closest permanent habitation is over 2.7Km from the portal.

Tunnel 3 Tagikamar – South Portal 500m from portal



Figure 48: Residential property within 500m of Tagikamar Tunnel South Portal

652. There are 6 residences within 500m of the Tagikamar Tunnel South Portal

Tunnel 3 Tagikamar – South Portal 1000m & 500m from portal

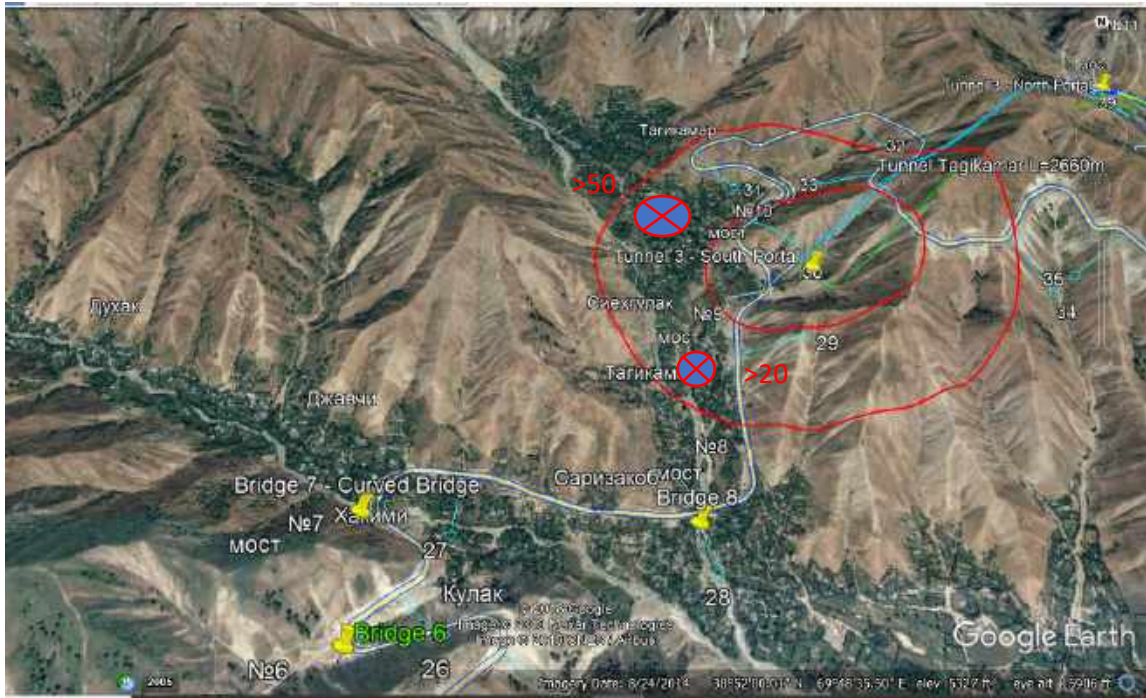


Figure 49: Residential property > 500m and <1000m of Tagikamar Tunnel South Portal

653. There are over 76 residences within 1Km of the Tagikamar Tunnel South Portal



Figure 50: Residential property within 500m of Tagikamar Tunnel North Portal

654. There are 4 residences within 500m of the Tagikamar Tunnel North Portal.



Figure 51: Residential property > 500m and <1000m of Tagikamar Tunnel North Portal

655. With 4 residences within 500m of tunnel the portal and 40 between 500m and 1000m there are 44 residences within 1Km of tunnel portal
656. There are safety risks specific to tunnel construction activities, including potential for rockfalls / collapse, storage and use of explosives, restricted access and escape routes for collapse, and work in enclosed spaces with potentially inadequate lighting and ventilation. These will need to be assessed and controlled for each work location, through the implementation of the Safety Management Plan.

Figure 52: Cross Section Through the Tunnel

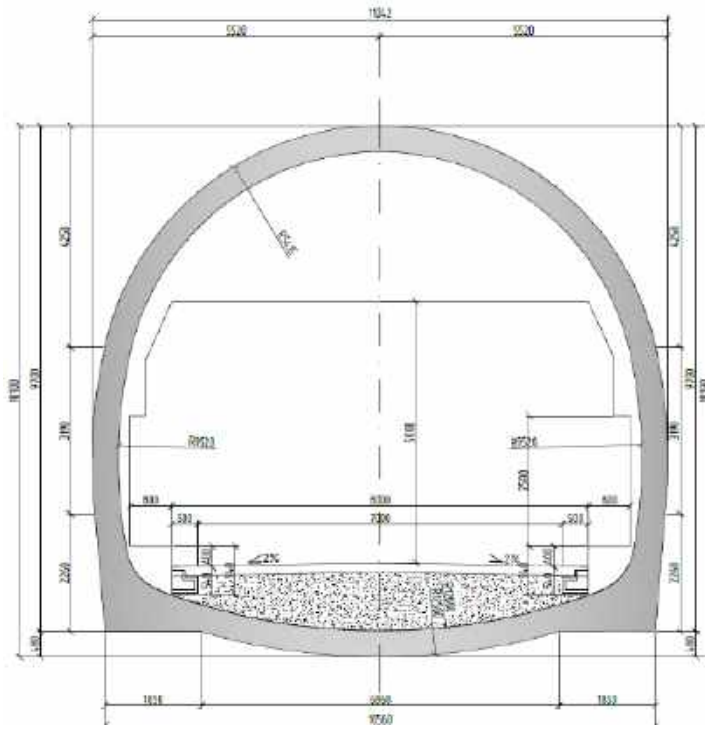


Figure 53: Location of Tunnels



7.3.22.2 Mitigation

657. A Tunnel Construction Plan will be developed to manage the impacts.
658. The Contractor shall develop a Blasting Management Plan for the construction of tunnels, including management of safety risks, particularly to workers. This will cross reference the Health and Safety Management Plan. The Contractor must appoint an authorised blasting contractor.
659. The Blasting Management Plan will also cross reference other sub-plans including; Water Resources Management Plan, Emergency Response Plan, Spill Management Plan, Air Quality Management Plan, Waste and Materials Management Plan, Stakeholder Engagement Plan, Biodiversity Management Plan and others as required.
660. With these mitigation measures management plans and mitigations in place the risk is assessed as “high” and the effect is considered significant, largely driven by health and safety considerations. For this reason, particular focus will be placed on monitoring of the implementation of ongoing mitigation and management risks and ensuring that mitigation measures are rigorously applied throughout construction.

RISK	RISK SEVERITY	RISK LIKELIHOOD	RISK LEVEL	SIGNIFICANT?
Site specific impacts – tunnel sites	MAJOR	POSSIBLE	HIGH ¹⁰⁴	NO

7.3.23 Site Specific Impacts – Borrow Pits and Waste Disposal Areas.

7.3.23.1 Impacts

661. Bulk earthworks for the project alignment were carried out in the Soviet era, so the need for new borrow areas is expected to be limited. Although, the need to adopt current design standards for the alignment means that additional material will be generated from material produced during cut slope trimming. Material from the cut slopes can be used in additional embankments on the alignment but a cut to fill calculation prepared by Avtostrada suggests an excess of 550,000m³ needing disposal¹⁰⁵.
662. Environmental impacts associated with the operation of borrow and disposal areas include includes: noise and dust impact, silty runoff and loss of habitat. In addition to the “soil” produced there will be around 4.5 million m³ of rock generated from slope cutting and a further 0.5 million m³ generated from the tunnels. Some rock material can be processed for use in the engineered sections of the road pavement, but this would use only a relatively small proportion of the available cut material. Table 51 sets out the presently estimated cut fill situation.
663. For the purposes of this EIA the Design Consultant has investigated potential locations for disposal sites on the alignment. This shows that there are sites available to dispose of excess material generated by the project. It is noted that it is

¹⁰⁴ The risk level of high is largely driven by health and safety considerations

¹⁰⁵ This “unbulked” quantity is a volume 300m x 300m x 6m high

the Contractor responsibility to develop and gain approval for a Spoil Disposal Plan. The sites identified by the Design Consultant are shown in Figure 55 to Figure 61 and characteristics are presented (including a site location) are identified in Table 52. The requirements for a Contractor Spoil Disposal plan are including in paragraphs following the site identification and a screening of the disposal sites is presented in Table 54 and Table 55

Table 51: Cut to Fill calculation indicating excess needing disposal

		On the Road			Off Ramps		Approaches		TOTAL			Excess				
		Excavation		Embankments	Excavation	Embankments	Excavation	Embankments	Excavation	Embankments						
		Rock	Not Rock		Non Rock		Non Rock		Non Rock							
Phase 1 Upto Bridge 3	1	932,169	860,464	336,972	35,042	31,410	1,756	2,381	897,262	370,763						
	2	959,226	106,581	217,827	57,620	25,319	0	1,687	164,201	244,833						
	3	660,409	125,792	188,516	6,746	16,021	833	605	133,371	205,142						
	Total Rock Phase 1		2,551,804	m3 excess rock for disposal						1,194,834	820,738		374,096	m3 excess earth for disposal		
			137	m x m x m									72	m x m x m		
	6 m high		652	m x m x 6m								6 m high	250	m x m x 6m		
	10 m high		505	m x m x 10m								10 m high	193	m x m x 10m		
		On the Road			Off Ramps		Approaches		TOTAL							
		Excavation		Embankments	Excavation	Embankments	Excavation	Embankments	Excavation	Embankments						
		Rock	Not Rock		Non Rock		Non Rock		Non Rock							
Phase 2: Tunnel 3 upto Durobod	4	143,033	878,629	356,859	4,374	6,625	2,843	48,101	885,846	411,585						
	5	770,414	630,339	417,440	8,196	4,014	91	84	638,626	421,538						
	6	717,793	587,286	766,237	52,165	35,946	116	976	639,567	803,159						
	7.1	244,781	416,790	338,997	38,875	42,282	0	0	455,665	381,279						
	7.2	0	15,971	380,873	0	0	0	0	15,971	380,873						
	8	78,777	76,549	137,571	0	0	1,427	2,024	77,976	139,595						
Total Rock Phase 2		1,954,798	m3 excess rock for disposal						2,713,651	2,538,029		175,622	m3 excess earth for disposal			
			125	m x m x m									56	m x m x m		
	6 m high		571	m x m x 6m								6 m high	171	m x m x 6m		
	10 m high		442	m x m x 10m								10 m high	133	m x m x 10m		
Combined Phase 1 and 2 quantities																
	Total Phase 1 and 2	4,506,602	m3 excess rock for disposal								Total Phase 1 and 2	549,718	m3 excess earth for disposal			

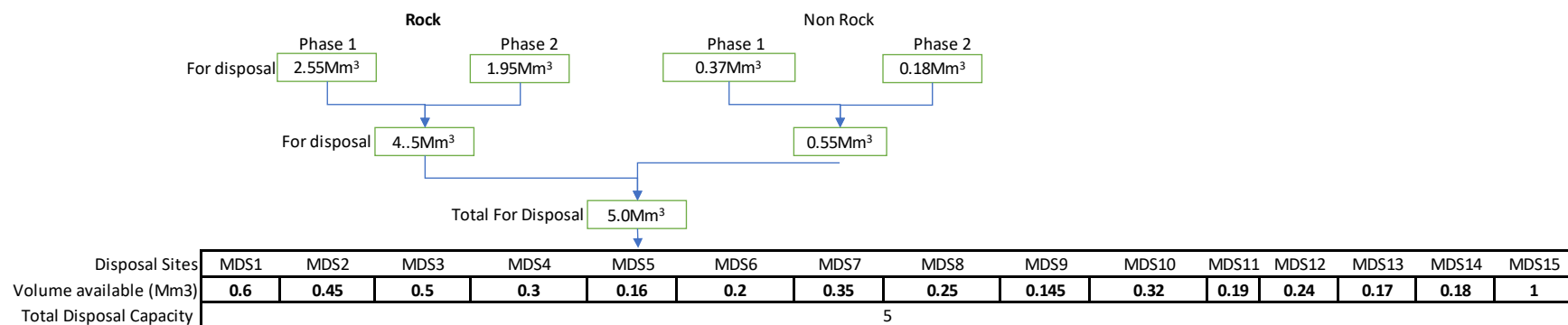


Figure 54: Summary of material needing disposal and disposal site capacity

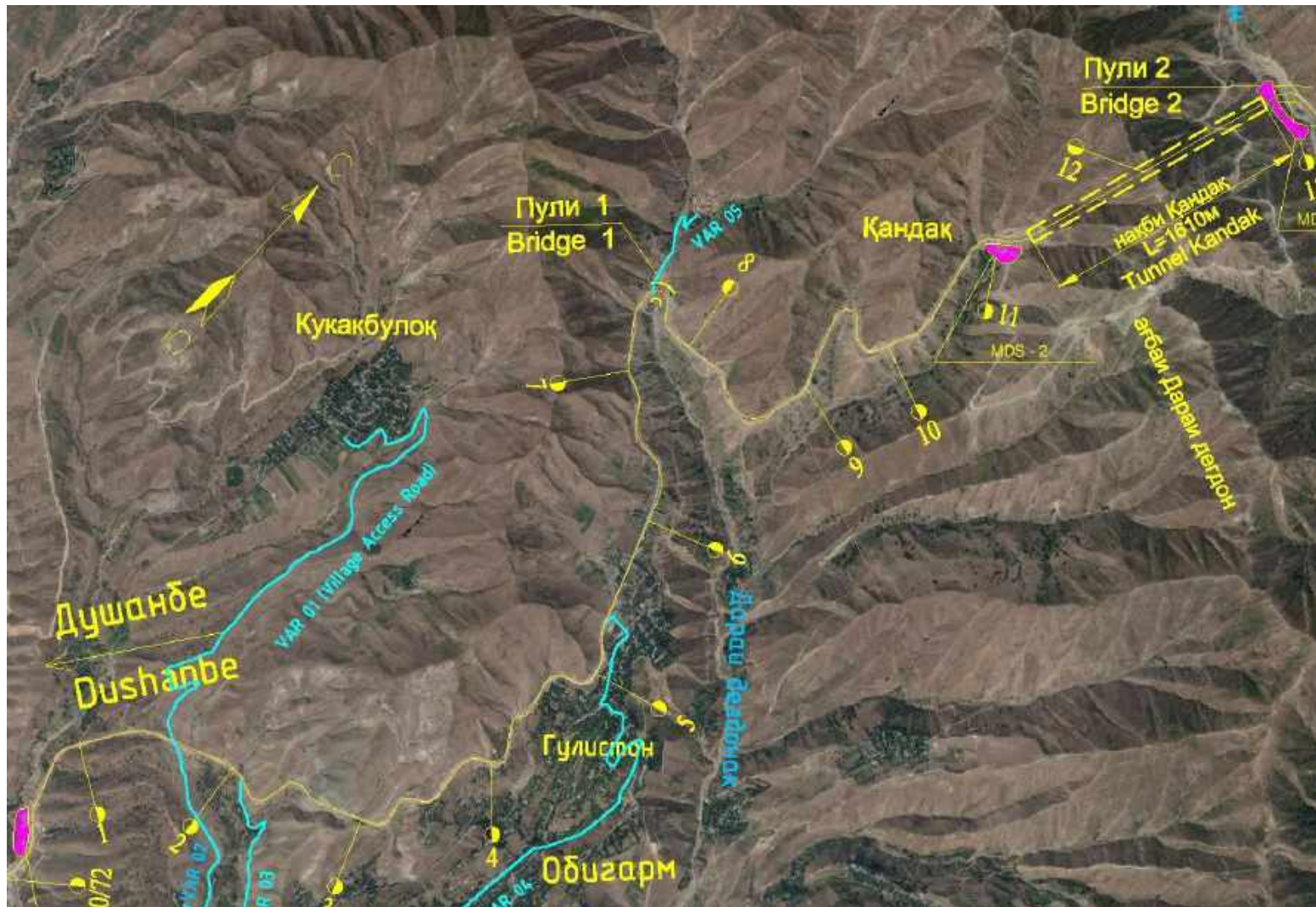


Figure 55: Spoil Disposal Sites (MD1 to 3) start to Tunnel 1

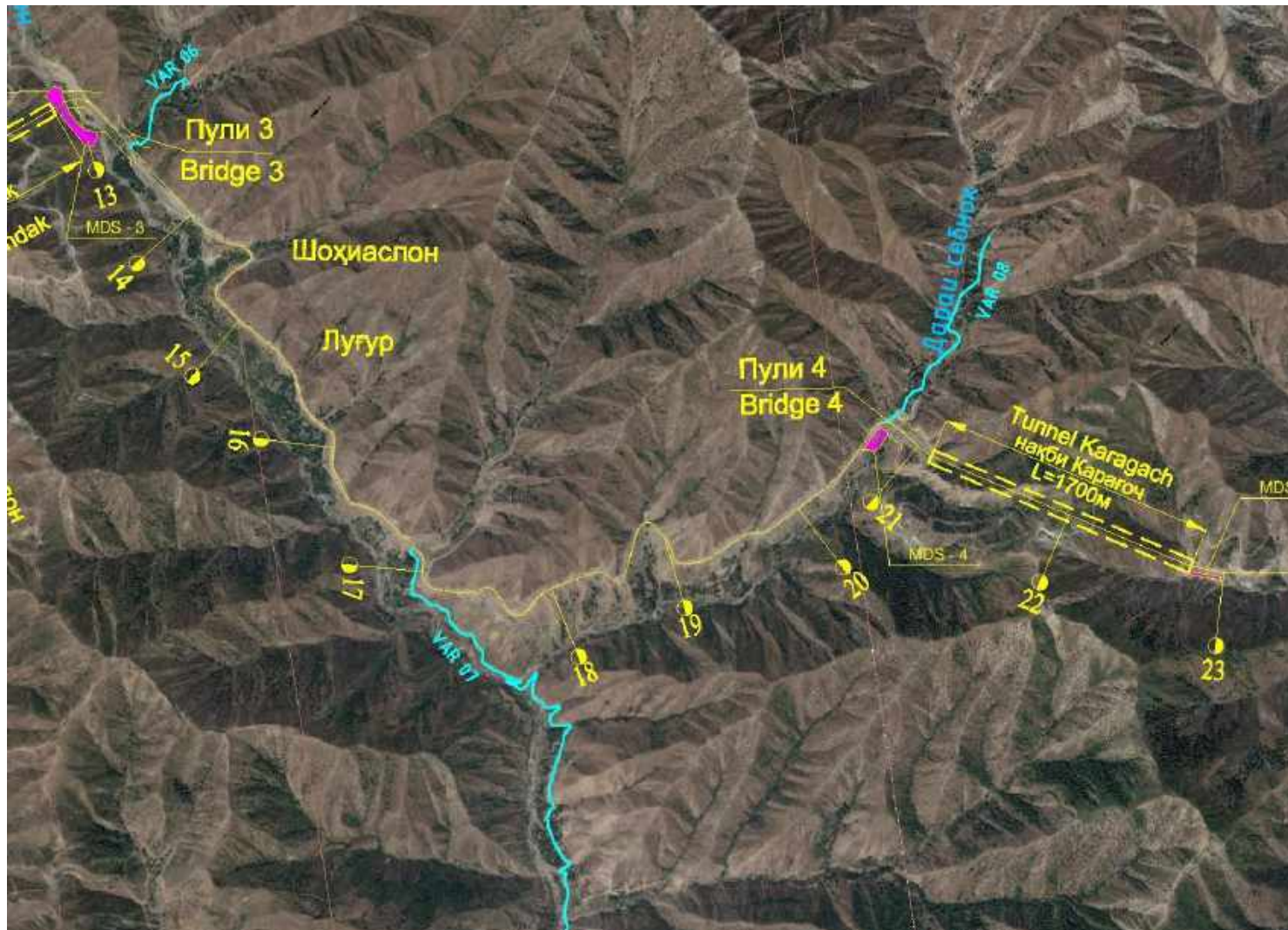


Figure 56: Spoil Disposal Sites (MDS3 to 5) Tunnel 1 to Tunnel 2



Figure 57: Spoil Disposal Sites (MDS5 to MDS7) Tunnel 2 to Tunnel 3

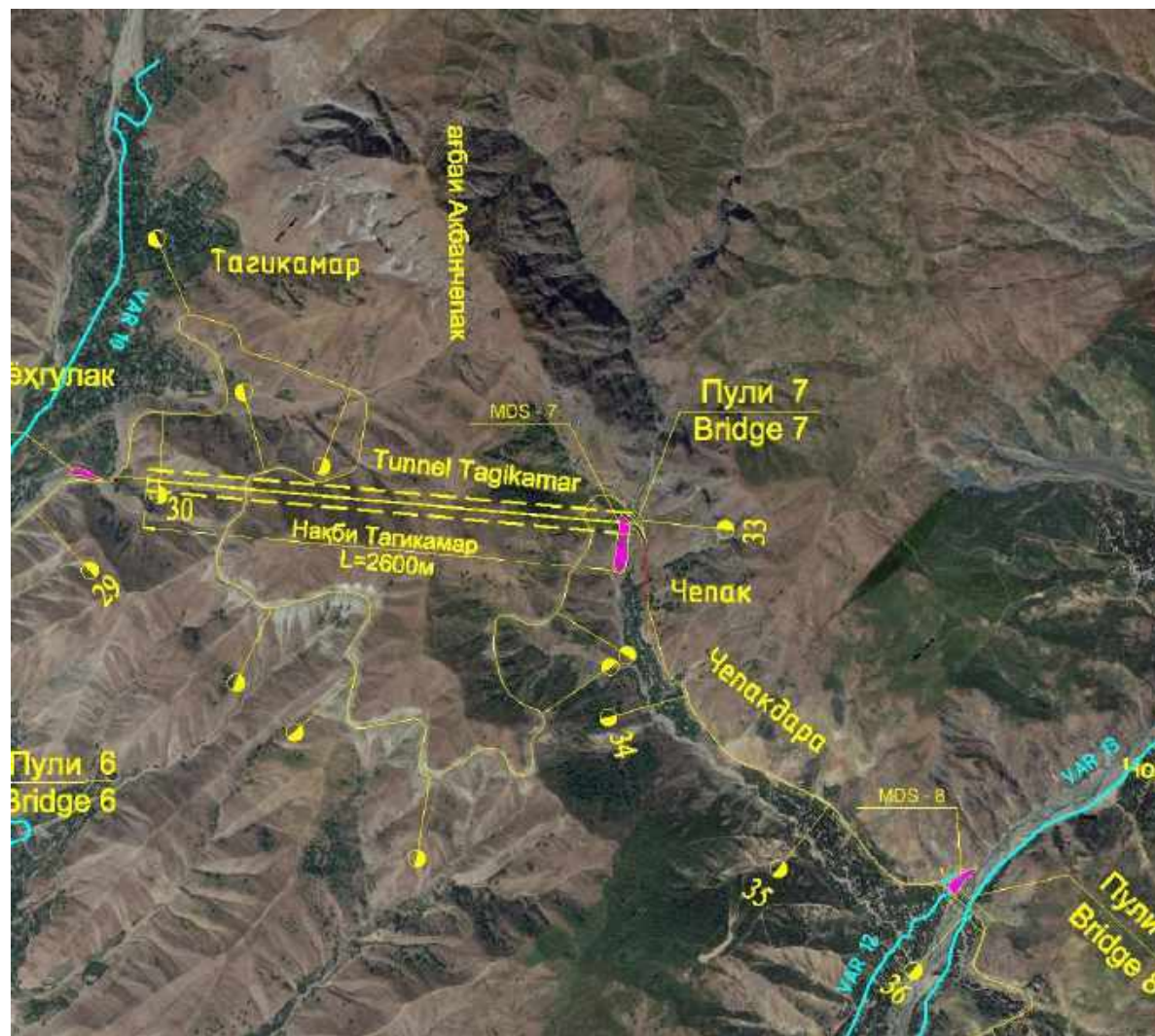


Figure 58: Spoil Disposal Sites (MDS7 to MDS8) Tunnel 3 east 1/4

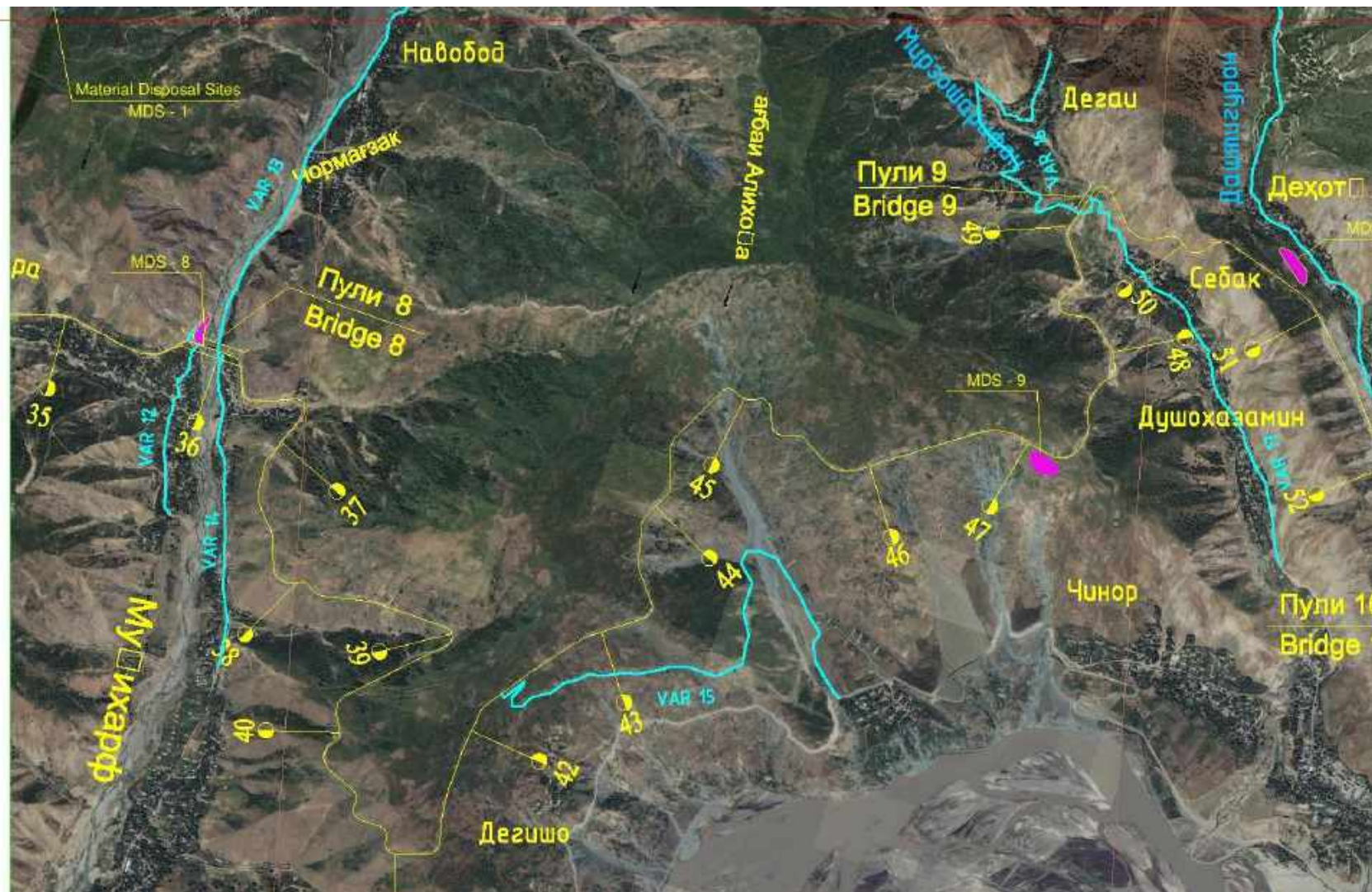


Figure 59: Spoil Disposal Sites (MDS8 to MDS10) Tunnel 3 eastwards 2/4

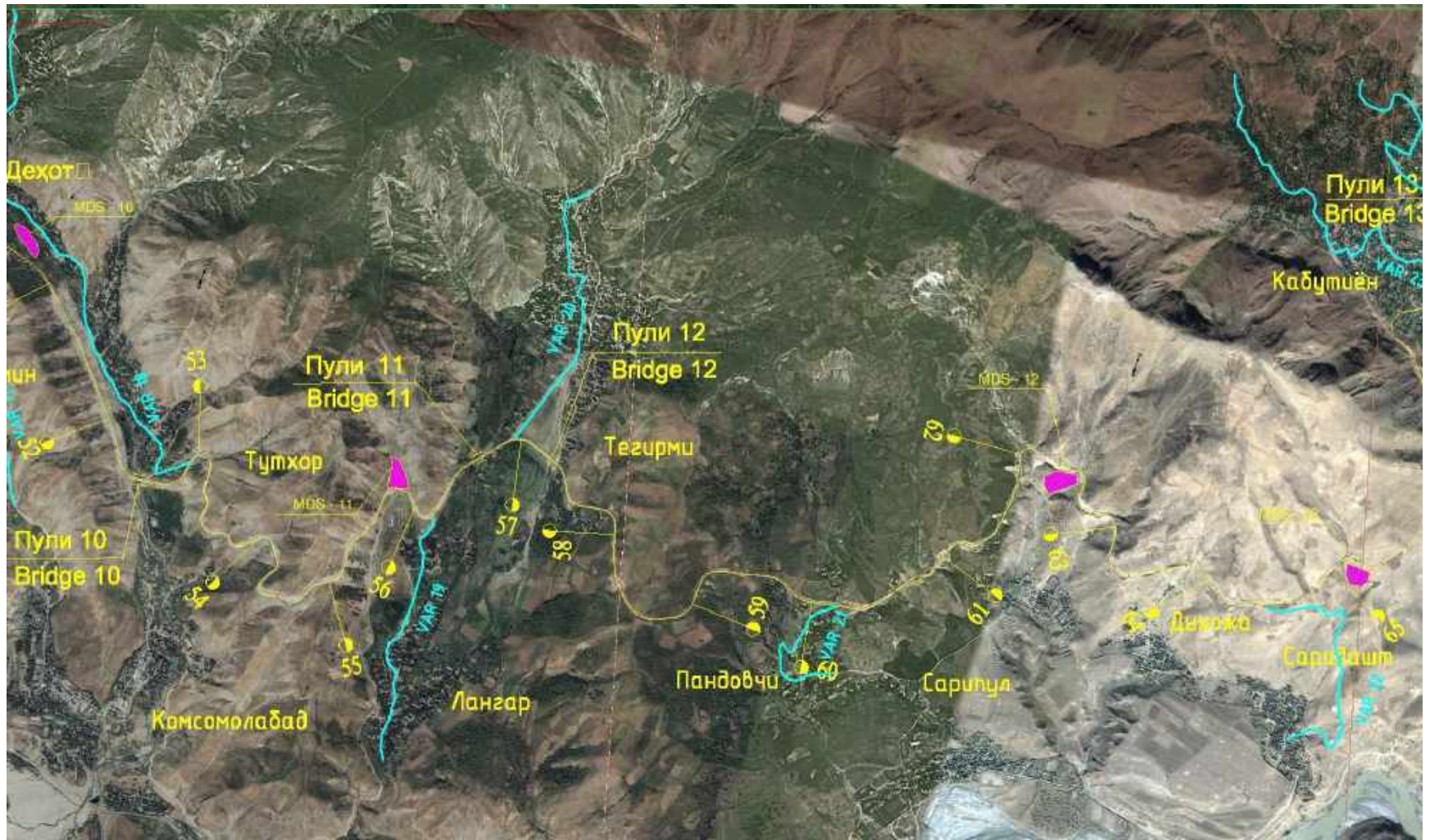


Figure 60: Spoil Disposal Sites (MDS10 to MDS13) Tunnel 3 eastwards 3 of 4

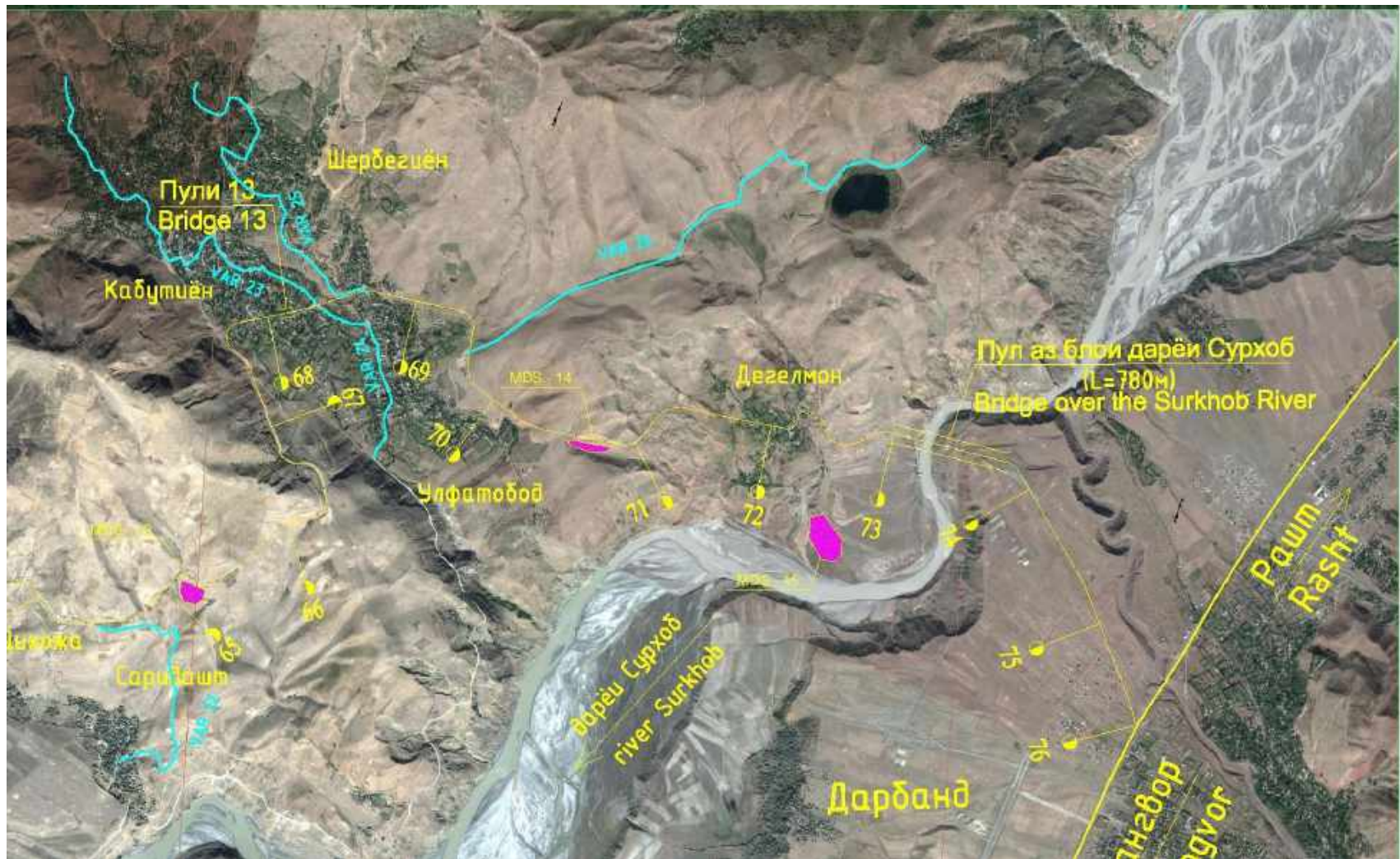



Figure 61: Spoil Disposal Sites (MDS13 to MDS15) Tunnel 3 eastwards 4/4


Table 52: Spoil Disposal Sites (Provisional)

ID	Km	Location	Description	Volume (m ³)	Village houses within 500 m	Watercourse	
MDS-1	0/72	West side of alignment	Depression	600 000	✕ No	No above alignment	

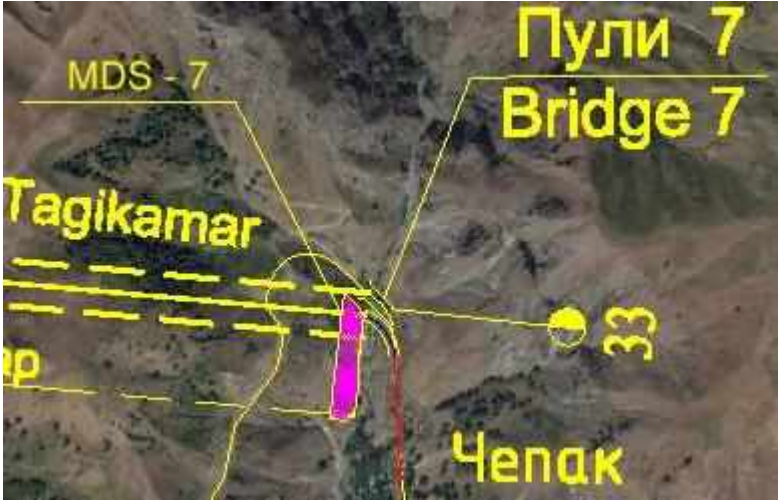
ID	Km	Location	Description	Volume (m ³)	Village houses within 500 m	Watercourse	
MDS-2	11	Kandak Tunnel West Portal	Top of river valley	450 000	✕ No	Upstream of	

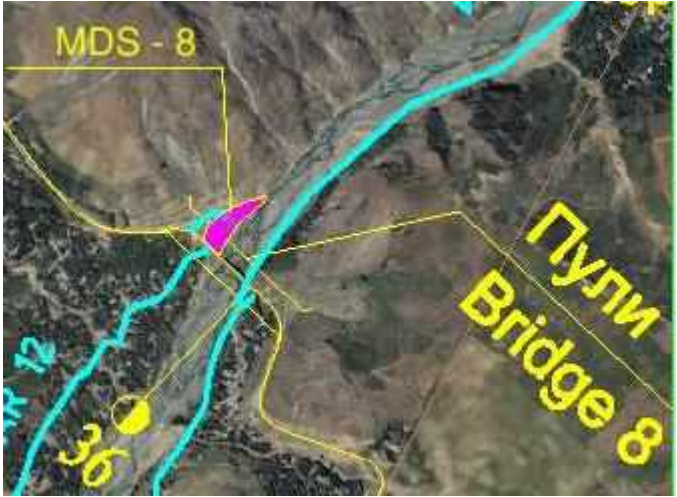
ID	Km	Location	Description	Volume (m ³)	Village houses within 500 m	Watercourse	
MDS-3	13	Kandak Tunnel East portal	On hillside immediately o/s portal	500 000	✕ No	Upstream of	

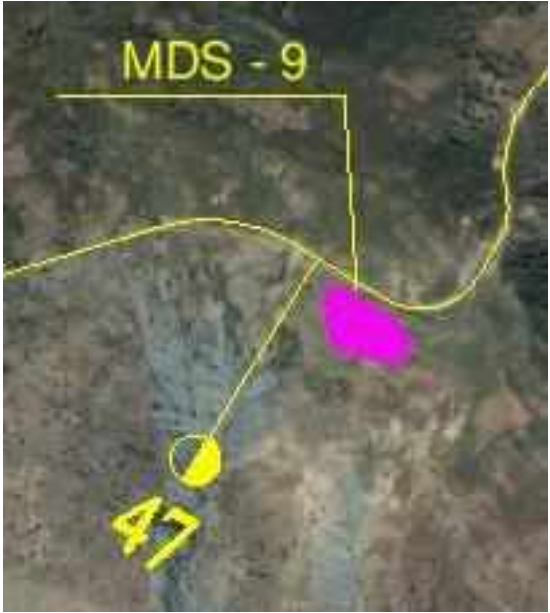
ID	Km	Location	Description	Volume (m ³)	Village houses within 500 m	Watercourse	
MDS-4	21	At Bridge 4 west abutment / Karagach Tunnel West Portal	In River valley d/s from alignment	300 000	✗ No	Upstream of	



ID	Km	Location	Description	Volume (m ³)	Village houses within 500 m	Watercourse	
MDS-5	23	Karagach Tunnel East Portal	Small site immediately outside portal	160 000	✕ No	Remote	

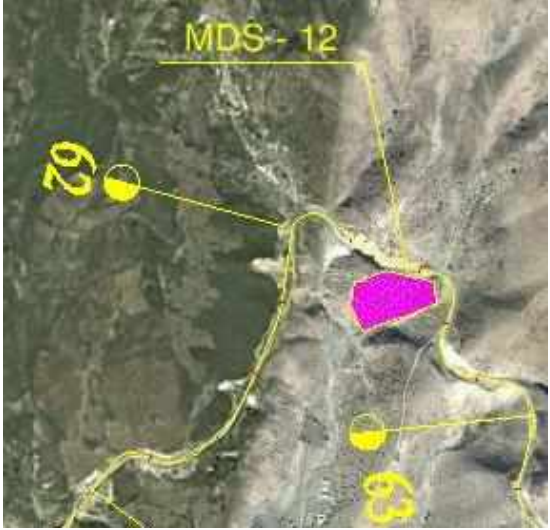
ID	Km	Location	Description	Volume (m ³)	Village houses within 500 m	Watercourse	
MDS-6	29.5	Tagikamar Tunnel West Portal	Small site in river valley immediately outside portal	200 000	✕ No	In river valley	


ID	Km	Location	Description	Volume (m ³)	Village houses within 500 m	Watercourse	
MDS-7	33	Bridge 7 Tagikamar Tunnel East Portal	In river valley immediately outside portal	350 000	✕ No downstream	In river valley	


ID	Km	Location	Description	Volume (m ³)	Village houses within 500 m	Watercourse	
MDS-8	36	Bridge 8	In river valley beneath bridge	250 000	✕ No downstream	In river valley	


ID	Km	Location	Description	Volume (m ³)	Village houses within 500 m	Watercourse	
MDS-9	47	Remote	upland hillside	145 000	✕ No	Remote	

ID	Km	Location	Description	Volume (m ³)	Village houses within 500 m	Watercourse	
MDS-10	51	Flatland east of alignment	In flood plain	320 000	Cedak village	In river valley	
MDS-11	56	Area upstream of alignment	In dry river valley	190 000	Tymxop d/s	Dry river valley	

ID	Km	Location	Description	Volume (m ³)	Village houses within 500 m	Watercourse	
MDS-12	62.5	Immediately south of alignment	Flat scrubland	240 000	Isolated agricultural buildings to south >500m	Dry river valley	 <p>The image is an aerial photograph showing a dry river valley. A pink polygon is overlaid on the valley floor. Two yellow circles are also present, labeled '62' and '69'. A yellow line connects the pink polygon to the label 'MDS-12'.</p>

ID	Km	Location	Description	Volume (m ³)	Village houses within 500 m	Watercourse	
MDS-13	65	Depression south of alignment		170 000	✕ No	No	

ID	Km	Location	Description	Volume (m ³)	Village houses within 500 m	Watercourse	
MDS-14	70.5	Depression south of alignment		180 000	× No	No	

End	MDS-15	ID	Km	Location	Description	Volume (m ³)	Village houses within 500 m	Watercourse	
			72.5	Large site south of alignment	In alluvial fan (within inundation)	1 000 000	✗ No	n/a within inundation	

664. The inappropriate siting and construction of disposal areas may have impacts due to:

- the generation of silty runoff and dust;
- long term stability (safety in the community);
- Poor design resulting in landscape degradation and loss of visual amenity; and

7.3.23.2 loss of valued habitats and biodiversity.Mitigation

665. To ensure that spoil disposal sites are identified and operated, and decommissioned correctly a Spoil Disposal Plan will be prepared by the Contractor as part of the SEMP. This will form part of the Waste and Materials Management Plan. The Spoil Disposal Plan must be developed in association with a biodiversity specialist and the Forestry State Department.

666. The Plan will be provided to the Engineer as part of his SEMP. No spoil storage will be allowed until the MoT through the Supervising Engineer have approved the plan and all licenses and approvals have been received.

667. The plan must address the issues that the Contractor must address when identifying, for approval Spoil Disposal Site(s) they propose for spoil disposal. The spoil disposal sites are part of the works and requires due diligence to be performed to confirm that they meet environmental safeguards standards identified in the EIA.

668. Therefore, an assessment must be prepared by the Contractor for approval by the Engineer and formally authorized by the PIURR of MoT prior to the application for licenses and approvals by relevant authorities.

669. The Contractor must ensure that disposal of excess spoil material will be undertaken in a manner that minimises environmental and social risks. The Contractor shall locate stockpiles away from any watercourse or wetlands to avoid sedimentation of these areas, protect stockpiles from erosion and show that during use and on completion that the stockpile is secure and stable.

670. The Spoil Disposal Plan shall include:

- information on location and layout of the spoil disposal areas (dimensions, slope angle) with 3D view and cross sections;
- surface water runoff management and bank protection measures;
- land rehabilitation and re-cultivation measures;
- designation of suitable transport routes and schedule for spoil truck movements to minimise traffic disruption/ congestion, and
- environmental mitigation measures to minimise impacts during transport, storage and disposal of spoil, including using covering truck.

671. Site specific information will include:

- Site Name (Contractor identifier and local)
- GPS co-ordinates
- Administrative location (Jamoat and Mahalla)
- Nearest habitation (name and distance)

672. The Contractor will also carry out a screening for each identified site including the following information. The screening shall cover both the site itself and the likely access route from the spoil generation point. An indicative screening process is identified in the following table and tables have been developed using the screening criteria to rank the disposal sites identified by the design team (Table 54 Lot 1 section and Table 55 Lot 2 section).

Table 53: Screening process for spoil disposal sites

#	Element	Issues to be included
1	Air quality Impacts	Closest sensitive use and mitigation measures
2	Hydrology Impacts	Impacts on hydrology
3	Topography	Stability of the site before during and post spoil disposal
4	Soils Impacts	
5	Flora Impacts	Confirmation of no species of interest or programme for protection
6	Fauna Impacts	Confirmation of no species of interest or programme for protection
7	Protected Area Impacts	Confirmation of no impact on protected areas (none currently identified in EIA)
8	Access Issues	Agreements for access with owners
9	Impacts to Local Community	Identify affected communities and confirm acceptable level of environmental (principally noise, dust and impact on water quality) and social (principally safety) impact . Has ownership been confirmed for the site and has provisional agreement been confirmed with the owner
10	Safety Issues	Access, stability and safety on access route
11	Noise Impacts	Quantify potential impact on nearest residential property
12	Archaeology / Physical and Cultural Resources	Impact on cultural / heritage items. Will link to chance find procedure derived by Contractor

673. The sites identified in this assessment have been developed by the design team and represent suitable sites that are available and are close to the sources of spoil generation they have not been the subject of any detailed environmental assessment. However, the sites identified have been subjected to an assessment using the screening criteria in Table 53. The results of the screening process are presented in the following tables (Table 54 Lot 1 section and Table 55 Lot 2 section).)

674. The screening uses a basic “impact” assessment with 1 as minimal no impact and 5 as severe / unacceptable impact. As there has been no detailed ecological / cultural heritage studies carried out at the sites all are ranked as 1 tbc in the assessment.

Table 54: Disposal sites ranked using the screening criteria – Lot 1 section

0	Disposal Site # >>	MDS1	MDS 2	MDS 3	MDS 4	MDS 5	MDS 6
			Tunnel1S	Tunnel1 N	Tunnel2 S	Tunnel2 N	Tunnel3 S
Overview	Volume of MDS Mm ³	0.6	0.45	0.5	0.3	0.16	0.2
	Km	0/72	11	13	21	23	29.5
	Characteristics	Depression	Kandak tunnel (w)	Kandak tunnel (e)	Karagach tunnel (w) In River valley d/s Bridge 4 adjacent	Karagach Tunnel (e) -	Tagikamar tunnel (w) adjacent. In river valley
	Nearest village (m)	>500m	>500m	Nil within 500m, 21 500m / 1000m	>500m	>500m	6 within 500m
	Watercourse	None close	Head of river valley	100m uphill	100m uphill	Head of river valley	In river valley
	Assessment element VVV	MDS1	MDS 2	MDS 3	MDS 4	MDS 5	MDS 6
1	Air quality Impacts	1	1	1	1	1	3 residential <500m
2	Hydrology Impacts	1	1	1	3	1	3
3	Topography Issues	1 natural depression	1	3 sloping site	3 sloping site	3 sloping site	1
4	Soils Impacts	1	1	1	1	1	1
5	Flora Impacts	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc
6	Fauna Impacts	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc
7	Protected Area Impacts	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc

8	Access Issues	1 direct from alignment	1 direct from alignment	1 direct from alignment	1 direct from alignment	1 adjacent to tunnel portal / alignment	1 adjacent to tunnel portal / alignment
9	Impacts to Local Community	1	1	1	1	1	4 residences <500m
10	Safety Issues	1	1	3 sloping site	3 sloping site	3 sloping site	3 Steep sides
11	Noise Impacts	1 remote	1 remote	1 remote	1 remote	1 remote	4 residences <500m
12	Archaeology / Physical and Cultural Resources	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc
	Score	12	12	16	16	16	21
	Overall Ranking	1	1	8	8	8	13
		MDS1	MDS 2	MDS 3	MDS 4	MDS 5	MDS 6

Table 55: Disposal sites ranked using the screening criteria – Lot 2 section

#	Disposal Site # >	MDS6	MDS 7	MDS 8	MDS 9	MDS 10	MDS 11	MDS 12	MDS 13	MDS 14	MDS 15
Overview		Tunnel3 S	Tunnel3 N	Adj Br 8							
	Volume of MDS Mm ³	0.2	0.35	0.25	0.145	0.32	0.19	0.24	0.17	0.18	1.0
	Km	29.5	33	36	47	51	56	62.5	65	70.5	
	Characteristics	Tagikamar tunnel (w) adjacent.	Tagikamar tunnel (e) adjacent.	In river valley beneath bridge	Remote Upland hillside	Flatland	Flat dry head of river valley	Flat scrubland	Depression close to alignment	Depression close to alignment	In alluvial fan – in the inundation
	Nearest dwellings	6 within 500m	>500m	4 within 500m	Nil	Cedak village	Tymxop	Remote >500m	Remote >500m	Village > 500m	Remote >500m

	Watercourse	In river valley	Head of river valley	In river valley beneath bridge	Nil	In flood plain	In dry river valley	In dry river valley	Nil	Nil	
		MDS6	MDS 7	MDS 8	MDS 9	MDS 10	MDS 11	MDS 12	MDS 13	MDS 14	MDS 15
1	Air quality Impacts	3 residential <500m	1 remote	3 residential (4#) < 500m	1	2 village is near >500m 1	2 village is near >500m	1	1	2 village is near >500m	1 remote
2	Hydrology Impacts	3	3 Head of RV	2 in river valley	1	3 flood plain	2 Head of dry rv	2 in dry rv	1	1	1 will be under water
3	Topography Issues	1	1	1	1	1 flat	1	1	1 depression	1 depression	1
4	Soils Impacts	1	1	1	1	1	1	1	1	1	1
5	Flora Impacts	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc
6	Fauna Impacts	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc
7	Protected Area Impacts	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc
8	Access Issues	1 adjacent to tunnel portal / alignment	1 adjacent to tunnel portal / alignment	3 beneath bridge	1 adj alignment	1 adj alignment	1 adj alignment	1 adj alignment	1 adj alignment	1 adj alignment	1 adj alignment
9	Impacts to Local Community	3 residences (4#) <500m	1 remote	3 residential (4#) < 500m	1 remote	3 village is near >500m	3 village is near >500m	1 remote	1 remote	3 village is near >500m	1 remote

10	Safety Issues	3 Steep sides	1	3 Steep sides	1	3 proximity to village	3 proximity to village	1 remote	1 remote	2 village is near >500m	1 remote
11	Noise Impacts	3 residences (4#) <500m	1 remote	3 residences (4#) <500m	1 remote	2 village is near >500m	2 village is near >500m	1 remote	1 remote	2 village is near >500m	1 remote
12	Archaeology / Physical and Cultural Resources	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc	1 tbc
	Score	22	14	23	12	20	19	13	12	17	12
	Rank	14	7	15	1	12	11	6	1	10	1
		MDS6	MDS 7	MDS 8	MDS 9	MDS 10	MDS 11	MDS 12	MDS 13	MDS 14	MDS 15

of the two access roads will be permanently rehabilitated the lower section will only be used in the construction phase. It is further concluded that as rehabilitation is limited to areas that service existing villages there are no residential developments in the lower section of the access road. Therefore impacts and mitigation are focused on the “permanent” access road sections.

679. The Contractor’s vehicles will only use temporary access roads during the construction phase of the project. The Contractor will be responsible for ensuring that the access road can be operated in a safe and environmentally acceptable manner. It is envisaged that cut material can be used as fill for the road so there will be no (or very minimal) excess material requiring disposal. For the temporary access the Contractor will grade the road using mechanical equipment and may need to improve coners to allow passage of long vehicles. The contractor is unlikely to use vibrating rollers or compactors for temporary construction. Impacts are therefore confined to dust generation from vehicles running on dry dusty surfaces and mitigation will be through damping down. Damping down should be carried out to ensure that silty runoff is not generated and passes to watercourses. To minimise traffic noise impact all vehicles shall be well maintained with efficient exhaust and noise muffling systems. Through the upper sections of the temporary access there are some village developments and the Contractor will be required to ensure that construction impacts from the passage of vehicles through the established villages are minimised. Watering to reduce dust generation and imposition and enforcement of speed limits through the villages shall be required.
680. **Permanent access roads.** Ultimately the existing road M41 will cease to exist and villages will be connected “uphill” to the new alignment on permanent access roads (see Figure 9 for location of the permanent village access roads). These permanent access roads are essentially an upgrade of existing roads, no new access road construction is proposed. There are 11 permanent access upgrades (30.25Km) in Lot 1 and 14 (44.8Km) in Lot 2.
681. The existing access roads which will be upgraded under this project are a MOT administered right of way (RoW) and there are no registered land and property rights within the RoW. Some fruit trees encroach into the RoW and these have been identified and owners will be compensated for loss¹⁰⁶. It was established during the field visits for the permanent access roads (July / Aug 2019) that the works will not impact on any homesteads, forests grassland or wildlife habitats, that all adjacent land is degraded by either commercial or residential development, there are no sites of special ecological interest.
682. Impacts and mitigation during construction of permanent access roads. The impacts and mitigation are identical to those required on the permanent alignment though, due to a less rigorous design, there will be slightly less activity on the permanent access roads compared to the main alignment and impacts will be reduced in terms of intensity. Potential Impacts noise and exhaust emissions from construction traffic, vibration during compaction with potential for structural

¹⁰⁶ There are 241 affected trees (age 3 to 50 years) and 491 shed trees and bushes (age 3 to 15 years). See Table 2 of the Community Access Roads – Rehabilitation Works document in Annex 9 of this EIA.

damage (see Section 3.7.8) for calculation of vibration impact and mitigation are the main areas of concern together with the migration of silty water to watercourses and spills. All these impacts are readily mitigatable by standard construction good practise techniques .

683. With standard construction mitigation the temporary and permanent access roads can be established with acceptable levels of environmental impact. As part of the Contractor SEMP a Construction Road Access Management Plan will be prepared by the contractor (See Section 8.6 – Pre Construction and Construction Phase EMP Table 73, item 29 Construction Road Access Management Plan

7.4 Operational Phase Impacts

7.4.1 Operational Phase Traffic Noise

7.4.1.1 Traffic flows

684. Rehabilitation of the road will increase traffic movements on the project alignment i.e. all traffic on the existing M41 alignment will be transferred to the new alignment. Detailed traffic information is included in section 5.14.10. In summary the traffic counts in September 2018 indicated that all traffic on the existing alignment would use the new alignment. There was no systematic difference between weekday and weekend traffic and a simple average was taken as representative of base year traffic.

685. Small passenger vehicles accounted for 84% of the observed traffic at Hakimi. Assuming the Karamyk border crossing remains closed, future growth is expected to be closely related to growth in GDP per head. Forecast normal passenger and light-medium goods traffic has therefore been assumed to grow at 4.3% per year from 2019 to 2026, thereafter growing at 3% per year.

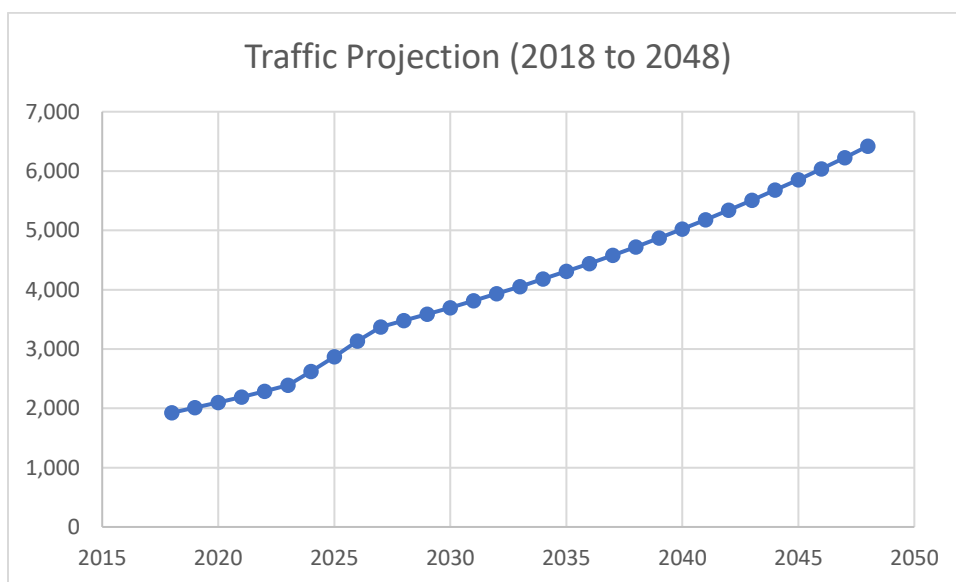


Figure 63: Traffic Growth on the Alignment (2018 to 2048)

7.4.1.2 The model used

686. To investigate the impact of traffic noise a specialized traffic noise prediction model has been created using *Soundplan*, a computer model that allows a 3 dimensional (3D) prediction of noise levels to be made¹⁰⁷. The *Soundplan* model builds on the engineering design information produced in Computer Aided Design (CAD) format. *Soundplan* superimposes traffic noise predictions (from number of vehicles, mix of traffic (HGV, cars, etc), speed, gradient of road) onto CAD information (alignment centerline, road edges, elevation, cross section and topographic (contours)).

¹⁰⁷ The traffic Noise modelling exercise was conducted by Kocks Consult GmbH, Stegemannstrasse, Koblenz, Germany. Report dated April 2019

687. The output is a drawing showing (i) a noise level contour (usually the 55 dB(A) daytime and 45 dB(A) nighttime contour representing the acceptable daytime and night-time traffic noise level respectively); and (ii) the actual noise level at a particular location (usually at a building on the alignment representing a sensitive use). Figure 64 shows a typical output from the soundplan model. A full set of the Soundplan outputs for the 2018, 2025 and 2033 traffic loading are included in Annex 7

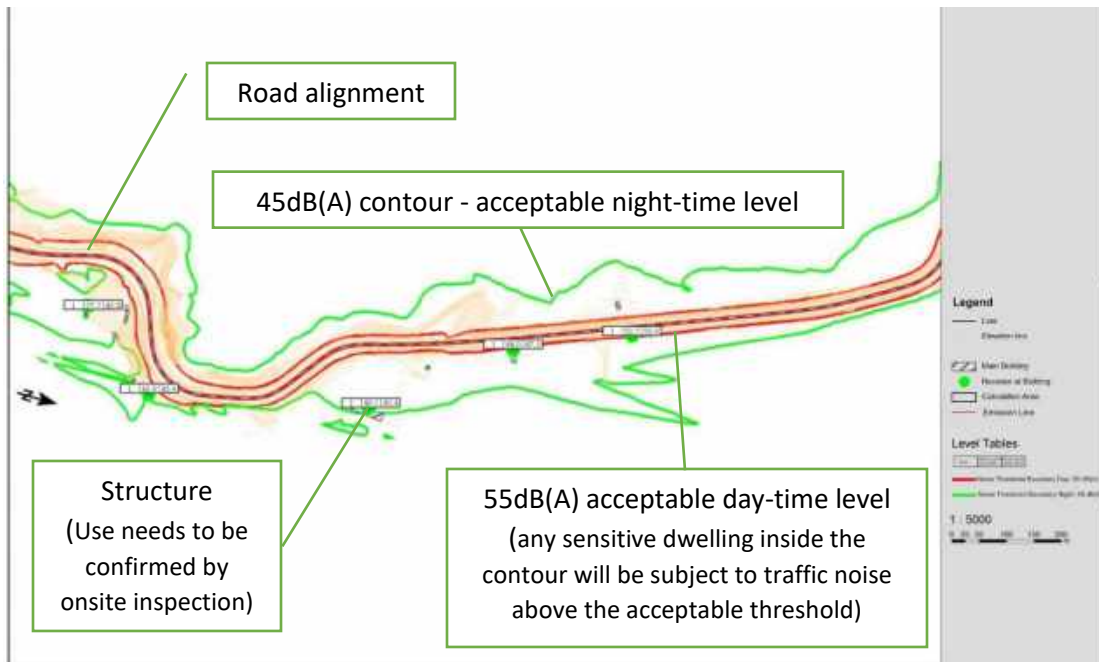


Figure 64: Output from the Soundplan model (Aug 2019)



Figure 65: Output from the Soundplan model overlaid on Google Earth (Aug 2019)

7.4.1.3 Criteria for traffic noise impact

688. The guidelines of the International Finance Corporation (IFC) have been used for assessing the impacts of traffic noise. This guideline provides criteria and guidance for noise control from a development beyond the property boundaries.

689. The criteria specify that noise levels measured at noise receptors must not be 3 dB(A) greater than the background noise levels or exceed 55 dB(A) during the day or 45 dB(A) during the night in residential areas and 70 dB(A) in commercial areas. Furthermore, the 3dB(A) criterion is also applicable for this project as there is some ambient background noise due to traffic movement on the existing gravel / earth road in the villages.

Table 56: IFC noise level guidelines used in traffic noise assessment

Receptor	One Hour LAeq (dbA)	
	Day time 07:00 – 22:00	Night time 22:00 – 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

Note: For acceptable indoor noise levels for residential, institutional, and educational settings refer to WHO, 1999

Source: IFC, EHS Guidelines, Noise Management

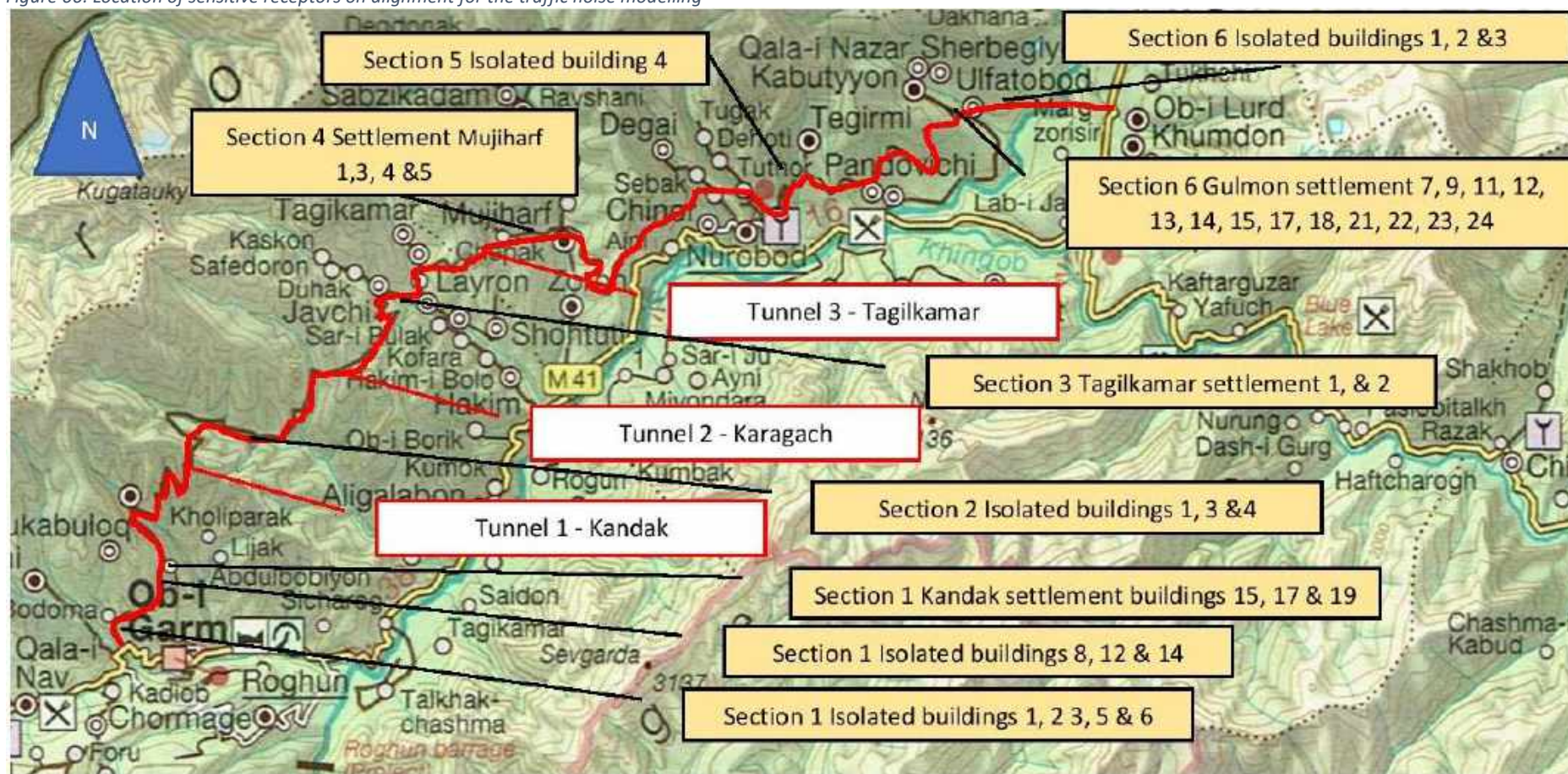
7.4.1.4 Receptor identification

690. The receptors in the study area were identified through interpretation of aerial photography (Google earth) and topographical survey data. Each receptor has been assigned a unique identifier for modelling and reporting purposes. All receptors are assumed to be one story residential buildings. The sensitive receptors are shown in Figure 66.

691. An onsite survey was carried out in June 2019 to determine the use of structures, their status, presence of compound walls that may shield noise to refine the impact assessment¹⁰⁸. It is noted that many residential developments are within a walled compound. The compound wall, if solid construction (mud brick, blockwork or steel) forms a noise barrier, shielding the sensitive development from noise impact. It was also observed during the survey that some of the existing structures cannot be considered as sensitive receptors as these are used for some other purposes such as a storage yard or a barn.

¹⁰⁸ A field survey of all the identified noise modelling points was carried out in June 2019. The assessment included visual inspection (to determine the structure use i.e. sensitive (residential, school, place of worship, etc.) or not sensitive (a storage shed / barn). Owners were interviewed and gave informal views on the need for barriers and other observations.

Figure 66: Location of sensitive receptors on alignment for the traffic noise modelling



Note 1: For precise locations of the sensitive receptors see Annex 3 in volume 2 of this document

692. It was noted that there was a higher proportion of non-sensitive structures at the east end of the alignment (Ulfatobod and Dekhitag villages in Safedchashma Jamoat) where there were greater numbers of non-sensitive barn structures and storage sheds close to the alignment.

693. During field surveys owners were identified and offered their views on the road. All were strongly supportive of the development of the alignment but had reservations about the installation of noise barriers citing concerns over loss of access and amenity. In addition, an owner of a property on the downhill side of the alignment welcomed the construction of a barrier for safety concerns during construction and operation (debris falling down the road batter during construction and vehicles running off the road during operation).

7.4.1.5 Traffic forecasts

694. Traffic noise increases with traffic volume and the proportion of heavy vehicles. Traffic forecasts for the base year 2018, and future year 2025 (after 7 years from the base year) and year 2033 (after 15 years from the base year) were provided for the project road by the Traffic Engineer. The provided traffic data for the project road are shown in Table 57 below.

Table 57: Traffic forecasts in Annual Average Daily Traffic (AADT)

Year	AADT				Sum
	Small pax	LMGVs	HGVs	TTs	
2018	1,695	79	139	12	1,924
2025	2,453	155	224	39	2,871
2033	3,373	263	336	80	4,052

695. Since the noise impacts are calculated during the one-hour period where the worst-case noise levels occur, the peak hour traffic volumes for day and night time have been derived from the forecasted traffic volumes based on the hourly distribution of the traffic established during the traffic counts. The hourly traffic data used for the noise modelling is shown in Table 58.

Table 58: Traffic Data for 2018, 2025 and 2033

Year: 2018 (Baseline year)	Day time	Night time
Light vehicles per hour	85	52
Trucks per hour	3	12
Total per hour	88	64
Year: 2025 (opening)	Day time	Night time
Light vehicles per hour	123	79
Trucks per hour	6	20
Total per hour	129	99
Year: 2033 (Peak)	Day time	Night time
Light vehicles per hour	170	114
Trucks per hour	10	33

Total per hour	180	149
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696. It should be noted that the percentage of heavier trucks is at night time higher than in day time. Considering that the worst hourly noise impact typically occurs when heavy truck volumes are the greatest, the loudness of traffic noise is higher at night time than at day time.

697. The lowest traffic noise for a typical traffic mix occurs at about 30 km/h. Increasing average vehicle speed above this increases traffic noise. Estimated operating speeds are used to predict road traffic noise levels and based on the road characteristic of the designed road. The vehicle speeds used in the noise modelling are shown in Table 59.

Table 59: Vehicle speed used in noise modelling

Vehicle speed (km/h)		Remarks
Cars	Trucks	
50	50	Mountainous terrain and partly passage through build-up areas

698. A traffic noise calculation has been done for a vehicle speed of 40 km/h for cars and trucks while passing through villages and settlements as per the local speed limit requirements.

7.4.1.6 Road surfacing

699. Different road surfaces generate different noise levels from tyres. The difference in noise emission (correction) between road surface types in accordance to RLS-90 is shown in Table 60.

Table 60: Noise emission correction values for different road surface types

Road Surface	Surface Correction dB(A) for Permitted Speeds			
	30 km/h	40 km/h	> 50 km/h	> 60 km/h*
Non-grooved mastic asphalt, asphalt concrete, or stone mastic asphalt	0	0	0	0
Concrete or grooved mastic asphalt	1.0	1.5	2.0	2.0
Block pavement with smooth surface	2.0	2.5	3.0	3.0
Other block pavements	3.0	4.5	6.0	6.0
Concrete with metal broom treatment	n/a	n/a	n/a	1.0
Concrete with smooth texture (burlap cloth)	n/a	n/a	n/a	-2.0
Asphalt concrete < 0/11 and stone mastic asphalt 0/8 & 0/11 aggregate size without chipping	n/a	n/a	n/a	-2.0
Porous asphalt with more than 15% voids and 0/11 aggregate size	n/a	n/a	n/a	-4.0
Porous asphalt with more than 15% voids and 0/8 aggregate size	n/a	n/a	n/a	-5.0

Note: * Outside settled areas

Low noise road surfaces should have a referred noise reduction of at least 2 db(A)

700. For noise modelling on this project roads with an asphalt surface have been adopted, as stated in the design documents and no correction factor has been used in the road noise calculation.

7.4.1.7 Modeling outputs

701. . The road noise prediction consists of the project road alignment and forecasted further traffic data. Noise levels for the base year 2018 and future years 2025 (after 7 years from the base year) and 2033 (after 15 years from the base line) were calculated and compared to the relevant criteria. The results of the noise prediction at the selected receptors are presented in Table 12 below. The location of the receptors, predicted noise levels and the corresponding noise contours for residential areas, are presented in Appendix 3 to 6.

702. It should be noted that due to the high truck traffic at night, the noise impacts at night are higher than in day time.

703. Although the traffic noise levels at some receptors exceed the desirable level of 55 dB(A) in daytime and 45 dB(A) in nighttime in accordance to IFC standard, it should be noted that the increase of the noise levels between the baseyear 2018 and the reference year 2025 will be less than 3 dB(A) and therefore no additional noise abatement measures are required till year 2025. The 3 dB(A) criteria is applicable as in settled areas the project road alignment will use mainly the right-of-way of the existing road. The area is pre-polluted due to existing traffic and the increase of the ambient noise level from the anticipated traffic increase is below the threshold of perception.

704. Considering the forecasted traffic levels for the reference year 2033, the predicted noise levels at most of the selected receptors will be above desirable levels and the difference between the base year and the reference year 2033 is about 4.2 dB(A), which is the above mentioned IFC threshold for noise increase. Therefore noise abatement measures are required.

705. In general following abatement measures could be considered when analyses indicate that the project will have noise impacts on sensitive noise receptors.

- Construction of noise barriers, including acquisition of property rights, either within or outside the highway right-of-way.
- Traffic management measures including, but not limited to, traffic control devices and signing for prohibition of certain vehicle types, time-use restrictions for certain vehicle types, and modified speed limits.
- Alteration of horizontal and vertical alignments.

706. Considering the mountainous terrain of the project area, **alterations of horizontal and vertical alignments** are technical difficult to implement and the feasibility of such measures is questionable.

707. **Traffic management measures** are the most cost effective noise abatement measures, but requires extensive monitoring by the traffic police to ensure compliance.

708. **Construction of noise barrier walls** is the most common noise abatement method. Essentially, a noise barrier is a solid structure that is constructed for the purpose of

reducing noise levels. The barrier works by blocking the path of sound waves from the highway source, forcing it around or over the barrier. The incident sound wave is either reflected or absorbed by the barrier surface. Sound can also be transmitted through the barrier, which is why the barrier must be constructed without gaps and be sufficiently dense. Therefore, privacy fences do not function well as noise barriers.

709. In order to meet the IFC noise criteria, noise barriers are designed along the project road in the vicinity of sensitive receptors. New Zealand Standard NZS 6806:20102 specifies that barriers should only be installed if they reduce noise levels by at least 3 dB at a cluster of houses or 5 dB at a single house.

710. Noise barriers are designed at settled areas with a height between 4 and 5 m. Alternative noise barriers with heights from 2 m to 4 m were also calculated, but for most of the receptors the achieved noise reductions are not sufficient to meet the IFC criteria and additional abatement measures would be required. Therefore only noise barriers with a height of 4 m and 5 m were considered.

711. Where a sidewalks are considered the noise barrier are located at the outer edge of the sidewalk. Outside settled areas, the noise barrier should be installed beside the shoulder in a distance of 0.5 m from the shoulder edge to allow implementation of protection and drainage measures. The implementation of noise barriers will significantly reduce the forecated noise levels and the noise criteria of the IFC guidelines could be observed, except of one case where the house is allocated above the road on a high cut slope. For this building additional measures might be considered, such as installation of soundproof windows or resettlement. The predicted noise levels with recommended noise abatement measures are presented in Table 63. The location of the noise barriers are shown on the maps, 'Receptor Location and Predicted Noise Levels for Year 2033 with Proposed Noise Abatement Measures (Noise Barriers)', presented in Annex 7 Appendix 6. The total lengths of the proposed noise barrier by design section is shown in the following table and an output from the soundplan model at the east end of the alignment showing the noise contours at 2018, 2025 and 2033 and at 2033 indicating the location of noise barriers is presented in Figure 66 (a, b, c and d) For the full set of contour outputs see the Traffic Noise Report in EIA Volume 2 Annex 7.

Table 61: Lengths of Noise barrier at 2033 scenario

Section	Barrier length (m)		Remarks
	5m high	4m high	
1	4,590	-	Obigarm
2	190	3,070	Sicharog
3	3,800	-	Hakimi
4	5,000	-	Mujiharf
5	300	-	Komsomolobo
6&7	5,950		Safedchashma
TOTAL	19,830	3,070	

Figure 67: Soundplan Output showing traffic noise contours at 2018, 2025 & 2033 (unmitigated & mitigated at 2033)

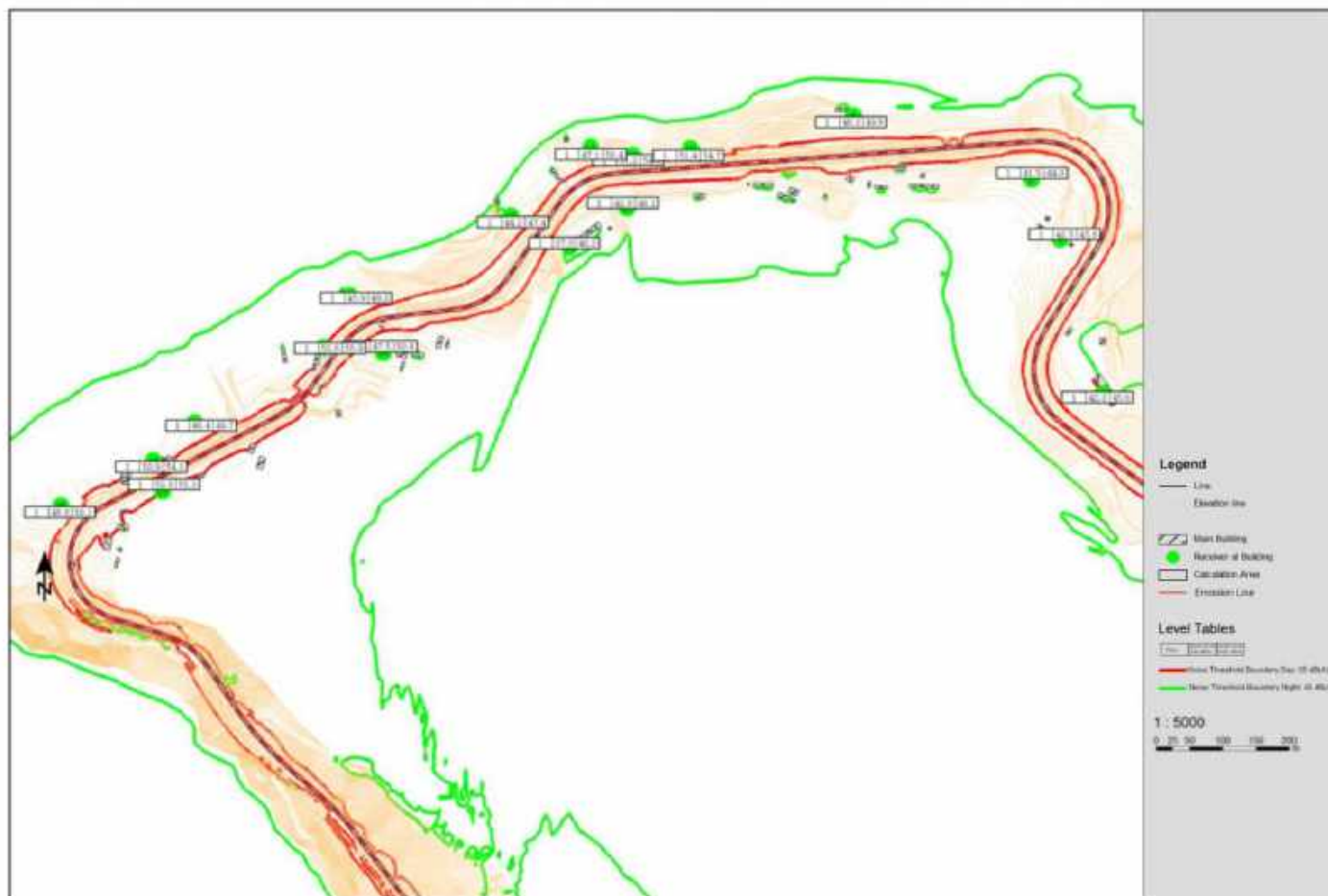


Figure 66a: Soundplan Output showing traffic noise contours at 2018 (unmitigated)

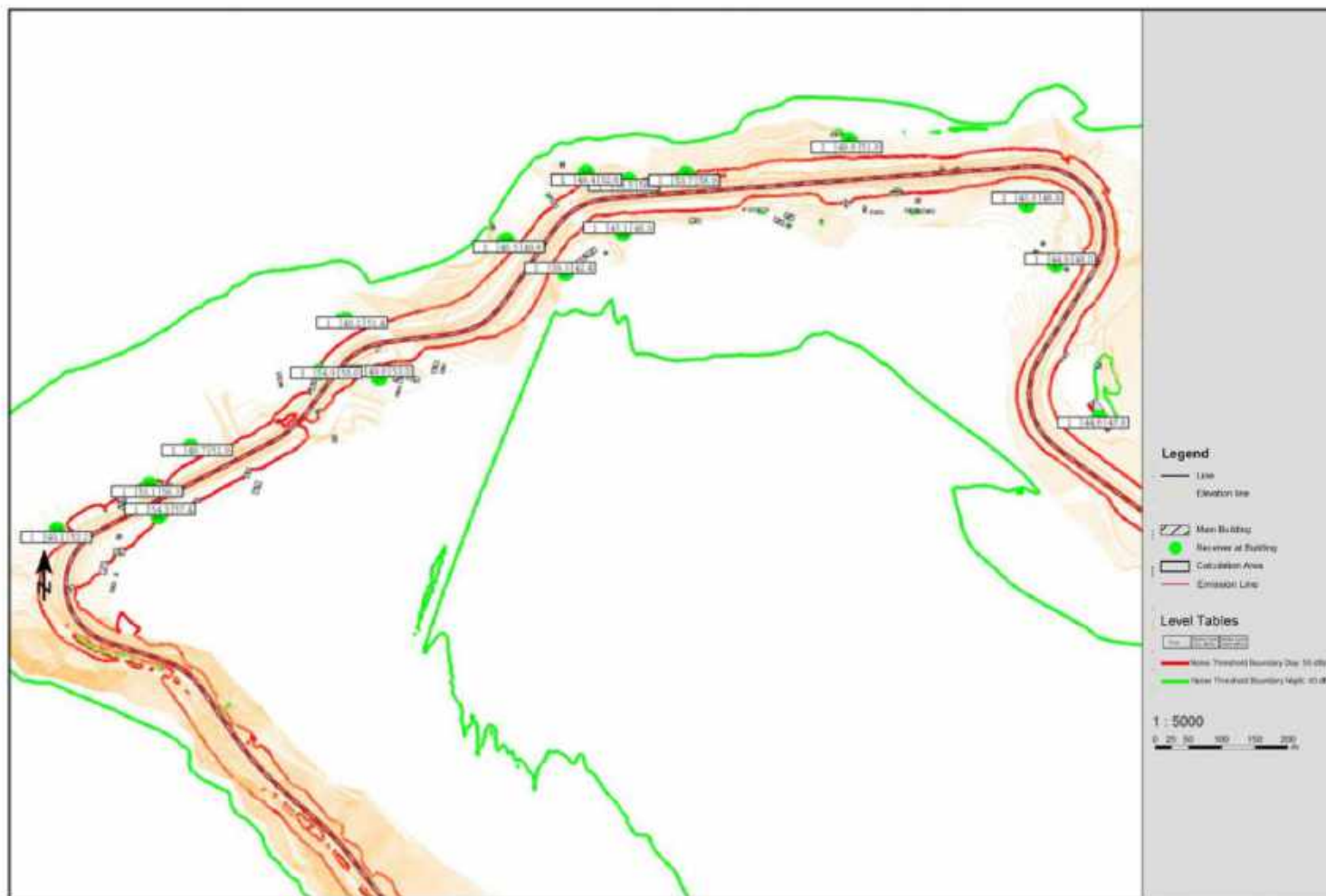


Figure 66b: Soundplan Output showing traffic noise contours at 2025 (unmitigated)

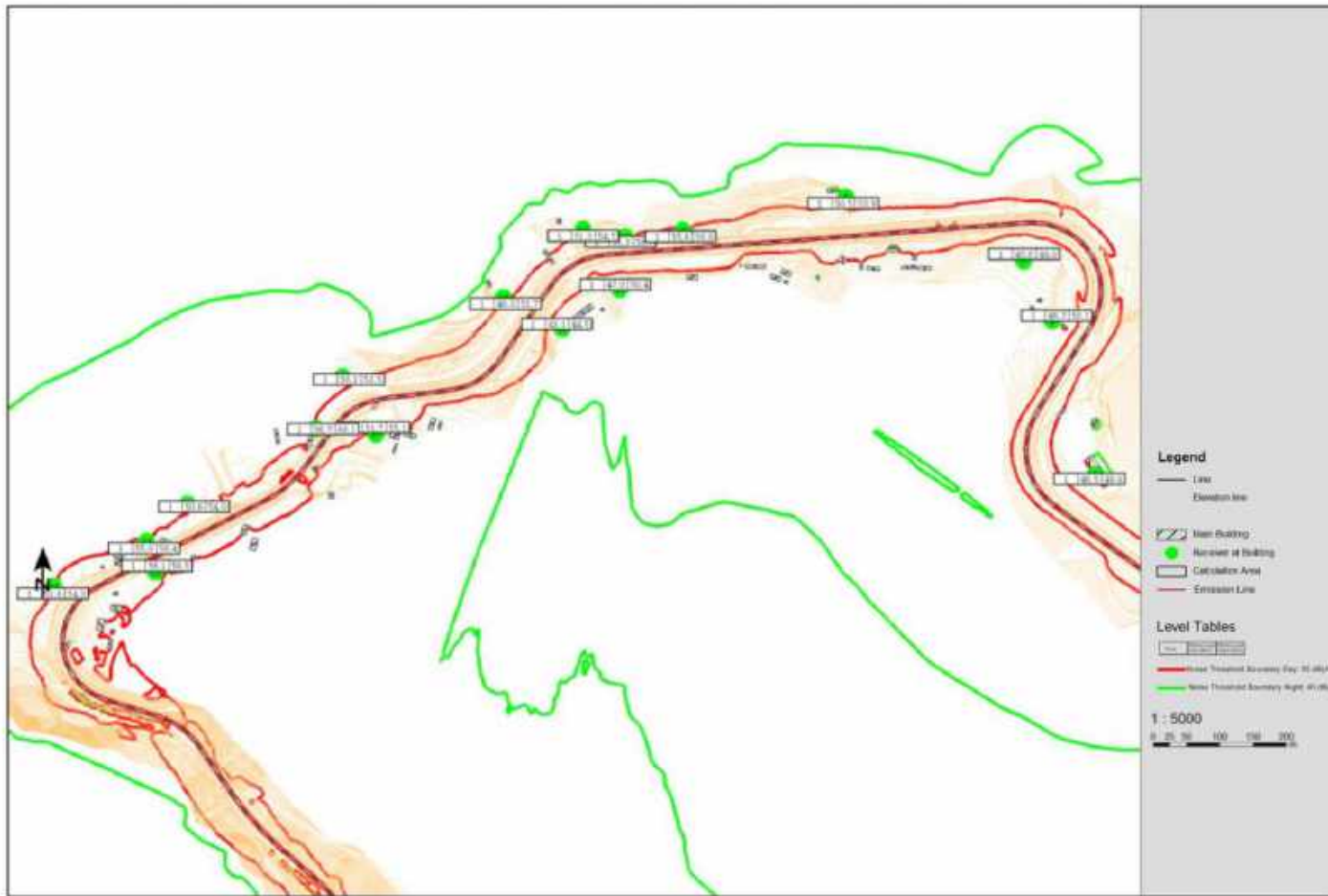


Figure 66c: Soundplan Output showing traffic noise contours at 2033 (unmitigated)

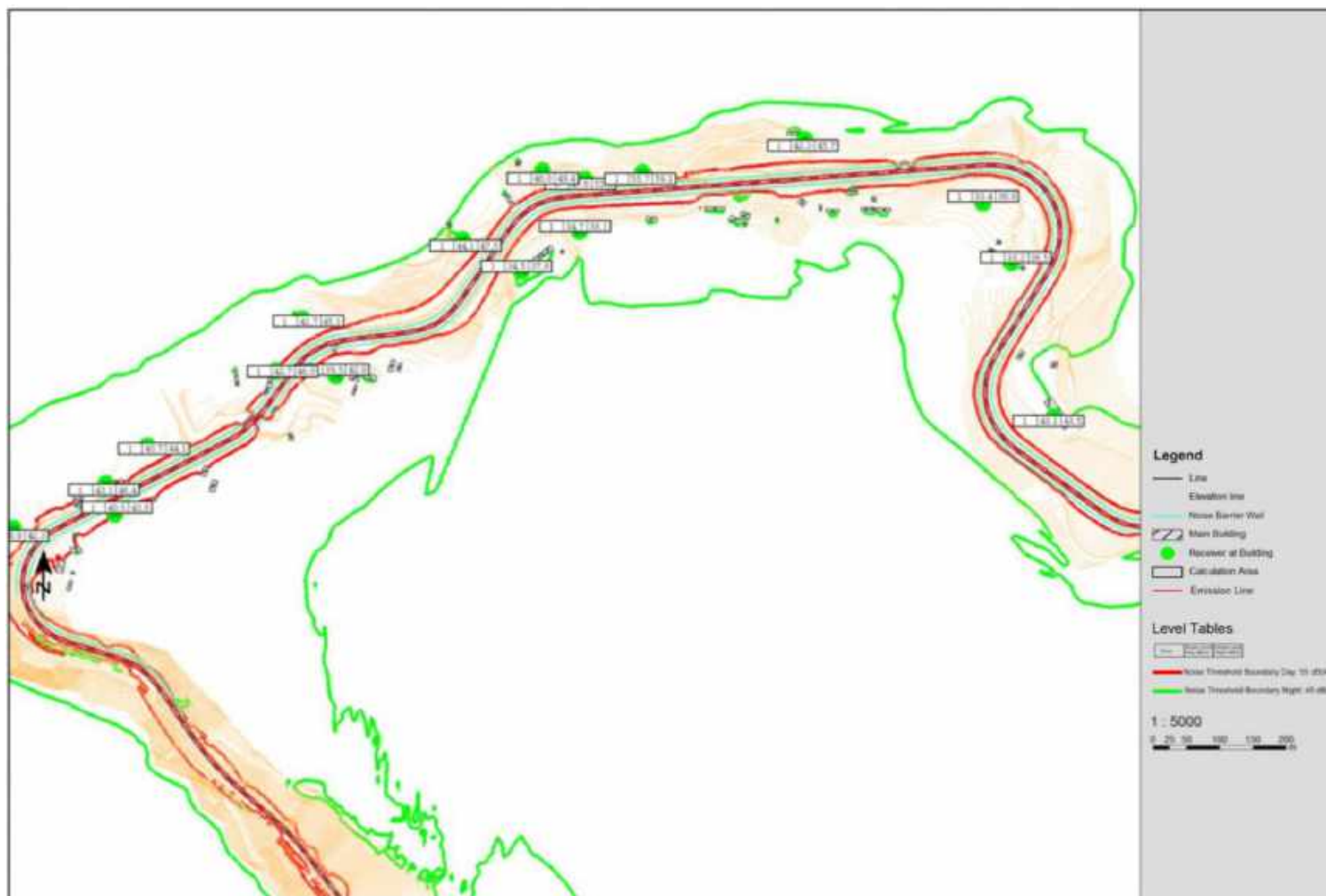


Figure 66d: Soundplan Output showing traffic noise contours at 2033 and noise barrier placements

7.4.1.8 Optimisation of noise barrier erection

712. However, prediction of future traffic on a new road is highly uncertain. Therefore it is recommended to monitor noise levels in annual intervals and, depending on the measured noise levels, implement noise abatement measures when the noise level exceeds the acceptable limits.

713. During the design of the noise barrier, more detailed noise calculation should be carried out to optimize the length and height of the noise barrier. As additional or alternative noise abatement measures, traffic management regulation might be considered. Potential noise abatement measures, in case of future exceedance of the noise criteria, could be:

- Further reduction of vehicle speeds to 30 km/h
- Restriction on truck driving at night time, will reduce the noise level at night, which is most critical in terms of exceedance of the desirable limits

714. The above mentioned traffic management measures will reduce the traffic noise levels and might be appropriate to avoid or postpone the implementation of noise barriers

Table 62: Results of the Traffic Noise modelling exercise for the project

Point No.	Works Package	Jamoat	Mahalla	SR Type	Permissible Noise Level IFC Guidelines dB(A)		Measured Ambient Noise Level		Predicted Noise Level 2018 in dB(A)		Predicted Noise Level 2025 in dB(A)		Predicted Noise Level 2033 in dB(A)		Difference Noise Level 2018-2025 in dB(A)		Requirement of additional noise protection measures
					LAeq day time	LAeq night time	LAeq day time	LAeq Night time	LAeq day time	LAeq Night Time	LAeq day time	LAeq night time	LAeq day time	LAeq night time	day	night	
1	Civil Works Package 1 - Western	Section 1 – Obigarm (western end of alignment)	Bozorak	Dwelling	55	45			44.8	48.1	47.1	50.3	49.0	52.3	2.3	2.2	No
2				Dwelling	55	45			37.6	40.8	39.8	43.0	41.7	45.1	2.2	2.2	No
3				Dwelling	55	45			38.2	41.5	40.5	43.7	42.4	45.8	2.3	2.2	No
5				Dwelling	55	45			42.9	46.2	45.2	48.4	47.1	50.5	2.3	2.2	No
8			Kandak	Dwelling	55	45			45.0	48.3	47.3	50.4	49.2	52.5	2.3	2.1	No
12				Dwelling	55	45			46.3	49.6	48.6	51.7	50.4	53.8	2.3	2.1	No
14				Dwelling	55	45			33.5	36.8	35.8	38.9	37.7	41.0	2.3	2.1	No
15				Dwelling	55	45			37.7	40.9	39.9	43.1	41.8	45.2	2.2	2.2	No
17				Dwelling	55	45			42.6	45.9	44.9	48.1	46.8	50.2	2.3	2.2	No
19				Dwelling	55	45			44.0	47.3	46.3	49.5	48.2	51.6	2.3	2.2	No
21				Dwelling	55	45			52.7	55.9	55.0	58.1	56.8	60.2	2.3	2.2	No
22				School (daytime only)	55	45	42.3	38.5	40.1	43.4	42.4	n/a	44.1	n/a	2.3	2.2	No
		Tunnel 1 - Kandak															
1		S2 Sicharog	Shohiaslon	Dwelling	55	45			44.9	48.2	47.2	50.4	49.1	52.2	2.3	2.2	No
3				Dwelling	55	45			46.1	49.4	48.4	51.6	50.3	53.7	2.3	2.2	No
4				Dwelling	55	45			33.5	36.7	35.7	38.9	37.6	41.0	2.2	2.2	No
		Tunnel 2 – Karagach															
1		S3 Hakimi	Javchi Poyon	Dwelling	55	45			52.1	55.4	54.4	57.5	56.2	59.6	2.3	2.1	No
2			Siyohgulk	Dwelling	55	45			54.1	57.4	56.4	59.6	58.3	61.7	2.3	2.2	No

3			Sadokot	Dwelling	55	45	45.4	41.4	44.4	47.7	46.7	49.9	48.6	52.0	2.3	2.2	
			Tunnel 3 - Tagikamar														
1	Civil Works Package 2	S4 Mujiharf	Chepak	Dwelling	55	45			50.0	53.3	52.3	55.5	54.2	57.6	2.3	2.2	No
3			Mujiharfi Kalon	Dwelling	55	45			44.7	47.9	46.9	50.1	48.8	52.2	2.2	2.2	No
4				Dwelling	55	45			48.4	51.6	50.6	53.8	52.5	55.9	2.2	2.2	No
5				Dwelling	55	45			36.4	39.7	38.7	41.9	40.6	44.0	2.3	2.2	No
6			Mujiharf	Dwelling	55	45	51.2	44.3	39.9	42.5	42.2	44.7	44.1	46.8	2.3	2.2	No
4		S5 Komsomol obod	Tutkhor	Dwelling	55	45			37.5	40.8	39.8	43.0	41.7	45.1	2.3	2.2	No
				Dwelling	55	45	46.3	44.1	44.5	47.7	46.8	49.9	48.7	52.0	2.3	2.2	No
1		S6/7 Safedchashma (East end of the alignment)	Dekhitag	Dwelling	55	45			46.3	49.6	48.6	51.8	50.5	53.9	2.3	2.2	No
2				Dwelling	55	45			51.4	54.7	53.7	56.9	55.6	58.9	2.3	2.2	No
10			Ulfatobod	Dwelling	55	45			42.8	46.1	45.1	48.3	47.0	50.4	2.3	2.2	No
11				Dwelling	55	45			50.9	54.1	53.1	56.3	55.0	58.4	2.2	2.2	No

Note 1: Red shading denotes exceedance of IFC guidelines as well as the 3dB(A) criteria

Note 2: For precise locations of the sensitive receptors see Annex 7 in volume 2 of this document

Note 3: Civil Works Package 3 consists only of construction of the long bridge with approach roads from km 72+900 - km 74+303

Table 63: Traffic Noise including noise barriers for 2033 scenario

Point No.	Location		Receptors		Difference Noise Level 2018-2033		Requirement of additional noise protection measures based on the 3 dB(A) between Base Year and Reference Year 2033	Recommended Noise Protection Measure	Predicted Noise Level 2033 with noise abatement measures in dB(A)		Difference Noise Level 2018-2033 with noise abatement measures in dB(A)		Noise treshhold value observed and/or noise increase between Base Year and Reference Year 2033 < 3 dB(A)
	Jamoat	Mahalla	Structure	Usage	in dB(A)				LAeq day time	LAeq night time	day	night	
					day	night							
CIVIL WORKS CONTRACT PACKAGE 1													
Design Section 1													
1	Obigarm	Bozorak	Building	Dwelling	4.2	4.2	yes	Noise wall, height 5 m	47.4	50.8	2.6	2.7	yes
2			Building	Dwelling	4.1	4.3	yes	Noise wall, height 5 m	35.5	38.8	-2.1	-2.0	yes
3			Building	Dwelling	4.2	4.3	yes	Noise wall, height 5 m	38	41.4	-0.2	-0.1	yes
5			Building	Dwelling	4.2	4.3	yes	Noise wall, height 5 m	37.4	40.8	-5.5	-5.4	yes
8		Kandak	Building	Dwelling	4.2	4.2	yes	Noise wall, height 5 m	45.7	49.1	0.7	0.8	yes
12			Building	Dwelling	4.1	4.2	yes	Noise wall, height 5 m	42.2	45.6	-4.1	-4.0	yes
14			Building	Dwelling	4.2	4.2	no		36.8	40.2	3.3	3.4	yes
15			Building	Dwelling	4.1	4.3	yes	Noise wall, height 5 m	32.5	35.9	-5.2	-5.0	yes
17			Building	Dwelling	4.2	4.3	yes	Noise wall, height 5 m	40.1	43.5	-2.5	-2.4	yes
19			Building	Dwelling	4.2	4.3	yes	Noise wall, height 5 m	38.8	42.2	-5.2	-5.1	yes

Point No.	Location		Receptors		Difference Noise Level 2018-2033		Requirement of additional noise protection measures based on the 3 dB(A) between Base Year and Reference Year 2033	Recommended Noise Protection Measure	Predicted Noise Level 2033 with noise abatement measures in dB(A)		Difference Noise Level 2018-2033 with noise abatement measures in dB(A)		Noise threshold value observed and/or noise increase between Base Year and Reference Year 2033 < 3 dB(A)
	Jamoat	Mahalla	Structure	Usage	in dB(A)				LAeq day time	LAeq night time			
					day	night					day	night	
21			Building	Dwelling	4.1	4.3	yes	Noise wall, height 5 m	41.9	45.3	-10.8	-10.6	yes
22		Gurun	Building	School No. 6	4.0	4.1	no		32.4	35.8	n/a	n/a	yes
Design Section 2													
1	Sicharog	Shohiaslon	Building	Dwelling	4.2	4.0	yes	Noise wall, height 4 m	38.8	42.2	-6.1	-6.0	yes
3			Building	Dwelling	4.2	4.3	yes	Noise wall, height 5 m	48.7	52.1	2.6	2.7	yes
4			Building	Dwelling	4.1	4.3	yes	Noise wall, height 4 m	31.3	34.7	-2.2	-2.0	yes
Design Section 3													
1	Hakimi	Javchi Poyon	Building	Dwelling	4.1	4.2	yes	Noise wall, height 5 m	38.3	41.7	-13.8	-13.7	yes
2		Siyohgulak	Building	Dwelling	4.2	4.3	yes	Noise wall, height 5 m	56.4	59.8	2.3	2.4	yes
3		Sadokat	Building	TBD	4.2	4.3	yes	Noise wall, height 5 m	43.5	46.9	-0.9	-0.8	yes
CIVIL WORKS CONTRACT PACKAGE 2													
Design Section 4													
1	Mujiharf	Chepak	Building	Dwelling	4.2	4.3	yes	Noise wall, height 5 m	52.5	55.9	2.5	2.6	yes
3		Mujiharfi Kalon	Building	Dwelling	4.1	4.3	yes	Noise wall, height 5 m	39.9	43.3	-4.8	-4.6	yes
4			Building	Dwelling	4.1	4.3	yes	Noise wall, height 5 m	46.4	49.8	-2.0	-1.8	yes
5			Building	Dwelling	4.2	4.3	yes	Noise wall, height 5 m	32.3	35.7	-4.1	-4.0	yes
6		Mujiharf	Building	TBD	4.2	4.3	yes	Noise wall, height 5 m	32.1	35.5	-7.8	-7.0	yes
Design Section 5													
4	Komsomolobo	Tutkhor	Building	Dwelling	4.2	4.4	yes	Noise wall, height 5 m	41.3	44.7	-5.3	-5.2	yes
Design Section 6 & 7													
0	Safedchashma	Tutkhor	Building	TBD	4.2	4.3	yes	Noise wall, height 5 m	34.9	38.3	-9.6	-9.4	yes
7			Building	Dwelling	4.2	4.3	yes	Noise wall, height 5 m	42.3	45.7	-4.0	-3.9	yes
9			Building	Dwelling	4.2	4.2	yes	Noise wall, height 5 m	55.7	59.1	4.3	4.4	no
10			Ulfatobod	Building	Dwelling	4.2	4.3	yes	Noise wall, height 5 m	34.7	38.1	-8.1	-8.0
23		Building		Dwelling	4.1	4.3	yes	Noise wall, height 5 m	43.1	46.4	-7.8	-7.7	yes

7.4.1.9 Noise Barrier Wall Design considerations

715. The primary function of noise barriers is to shield receivers from excessive noise generated by road traffic. Noise walls are probably the most widely recognised form of traffic noise mitigation, but also one of the most significant visual elements in a highway and their cost can be significant.
716. A barrier creates a “shadow zone” behind it, reducing the energy of the sound waves in a comparable way to a breakwater protecting a harbour. Because of the diffraction of sound by the edge of a barrier, the benefits decrease as the point of reception moves further away from the barrier.
717. **Where to locate the barrier.** In principle it is most effectively located as close to the source of sound (ie the road) as possible, except where the road is in a cutting when it is better to place the barrier at the top of the cutting where it will have greater effect. In settled areas, where a sidewalk is considered the noise barrier should be located at the outer edge of the sidewalk. Outside settled areas, the noise barrier should be installed beside the shoulder in a distance of 0.5 m from the shoulder edge to allow implementation of protection and drainage measures.
718. In general, the higher the barrier, the greater the level of noise reduction, but in practice aesthetic and cost issues must be seriously considered before constructing high walls. Where barriers are located on both sides of a road, the finish of the barriers should be considered. An absorptive treatment may be appropriate to reduce the impact of reflected noise.
719. The height and location of the noise barrier relative to the road are determined by the noise calculation and vary between 4 m and 5 m.
720. **Continuity.** Noise barriers must be continuous to have a mitigating effect. Sound “leaks”, due to holes, slits, cracks or gaps through or beneath a noise barrier, can seriously reduce the barrier performance, and should be avoided. This presents a challenge when providing access, that requires careful design resolution.
721. In practice this is not always possible – for example it is often necessary to break walls to allow access for pedestrians or cyclists, emergency vehicles, or inspection and maintenance access. Overlapping walls is one solution to this problem.
722. **Reflections.** A barrier which protects properties on one side of a road can also reflect noise back across it, increasing noise levels on the opposite side. If the barrier is imagined as a mirror, the reflected noise appears to come from an image source on the far side. But the effect decreases as the distance across the road increases relative to the distance between the source and the receiver.
723. Multiple reflections of traffic noise between two parallel plane surfaces, such as noise barriers on both sides of a road, can reduce the effectiveness of individual barriers and contribute to overall noise levels.
724. Therefore the use of highly absorptive surfaces for the noise barriers should be considered and have been applied in the noise calculation.
725. Applying noise absorptive materials reduces the noise level experienced by drivers on the road, but can produce also some noise reduction away from the highway by reducing sound that is reflected from the barrier on the side of the road opposite to the receiver.
726. **Aesthetics of noise barriers.** There is no dispute that the roadside barriers erected would protect residents living next to roads from excessive traffic noise. However, the

roadside barriers itself could also affect the aesthetical perception of both road users and residents.

727. In view of the linear nature of the noise barrier, simple plan vertical shape appears to be monotonous and creates a wall effect. The visual quality can be enriched through manipulation of the linear form, such as segmentation, curving and articulation of the surface texture and colour.

728. The overall appearance of barriers could be further articulated through applying of architectural concepts such as rhythm, proportion, order, harmony and contrast (not in any priority order). Such considerations are particularly useful where tall or extensive lengths of barriers are required in urban areas and where it may be desirable to break down the scale of an otherwise monolithic feature by using combination of contrasting materials

729. Materials. In general, barrier materials should be evaluated based on acoustical effectiveness (mass), structural integrity, durability, and initial and life-cycle cost.

730. In order to minimise the need for maintenance, attention should be paid to the selection of materials used in the construction of noise barriers. The mixing of different wall types and materials should be avoided where possible.

731. Following general material requirements should be considered:

- All exposed metal components, including connectors, should be fabricated of nonferrous materials or of stainless steel, or be hot-dip galvanized after fabrication according to the requirements of ASTM A 123, A 153, A 307, or A 325. All exposed steel (except weathering steel) must be primed and painted.
- Any welds should conform to the ANSI/AWS D1A, Structural Welding Code for Reinforcing Steel. All field welds should be cleaned and painted with an organic zinc-rich paint matching the color of the surrounding surfaces.
- All barrier materials should be tested in accordance with ASTM E84 to determine their flame-spread and smoke-development classifications.
- All barrier materials should demonstrate satisfactory performance under prolonged periods of exposure to moisture. Edges of absorptive materials should be sealed to preclude moisture from entering the interior. Water absorption testing should be performed in accordance with the ASTM standard appropriate for the material being tested.
- All barrier materials should demonstrate resistance to fungus in accordance with ASTM G 21 or a comparable standard.



Plate 12: Perforated metal noise barrier

7.4.1.10 Other Mitigation options during operation

732. An Operational Noise Management Plan will be developed and implemented by the Maintenance Department of the MoT and will include provisions for emissions monitoring, noise related grievance investigation and resolution, and additional mitigations if identified as necessary.

733. The following mitigation measures are suggested to reduce the noise levels during the operation phase:

- Reduction of vehicle speeds to 30 km/ will reduce the noise levels by approximately 2.7 dB (A)
- Ban on truck driving at night time, will reduce the noise level at night by approximate 7.1 dB(A);
- Noise-reducing porous asphalt road surfacing;

734. In summary with traffic noise mitigation measures in place, the environmental risk to the community is assessed as “low” and the noise effect is not considered significant.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Noise from road traffic	MINOR	POSSIBLE	MEDIUM	NO

7.4.2 Operation Phase Traffic Air Quality

7.4.2.1 Mathematical modelling – background information

735. A dedicated quantitative air emission exercise for the alignment has been carried out for the project. The mathematical model selected was RLuS 2012¹⁰⁹. The full text of the Air Emission Assessment is included in Annex 10 of this document and is summarised here.

736. Combustion engines in motor vehicles cause air emissions which result in ambient air pollution. In particular the following substances are emitted and are used in the model to predict impact¹¹⁰:

- Nitrogen monoxide (NO)
- Nitrogen dioxide (NO₂)
- Coarse (2.5 - 10 µm¹¹¹) atmospheric particulate matter PM₁₀
- Fine (less than 2.5 µm) atmospheric particulate matter PM_{2.5}
- Benzol (C₆H₆)
- Carbon monoxide (CO) – background measured in the field 2018. See Table 21
- Sulphur dioxide (SO₂) – background measured in the field 2018. See Table 21

737. In the model, emission factors are extracted from the Handbook Emission Factors for Road Transport (HBEFA)¹¹² a Microsoft Access database application developed on behalf of the Environmental Protection Agencies of Germany, Switzerland, Austria, Sweden, Norway and France. RLuS2012 uses the HBEFA to define the emitted pollution products of the vehicle fleet. This is based on information collected across Europe for different vehicle fleets and driving conditions throughout a working day i.e. it is a database of real operating conditions. So, in summary, the RLuS model uses HBEFA that is a more comprehensive emitted pollution product database that used in traditional air pollution models. It is the European standard and the most comprehensive database of vehicle emissions available. There is no equivalent Central Asia database. While the modelled emitted pollution products on the project road may not exactly mimic the situation in Tajikistan (where there is no accurate data on emissions or indeed across Central Asia) they very accurately depict real life roadside situations. At the low traffic volumes identified for the project, the model outputs are considered to accurately reflect air pollution levels likely to be experienced at receptor points.

¹⁰⁹ The German Research Society for Road and Transport in consultation with the Federal Ministry of Transport has derived a traffic air pollution model developed on the Merkblatt über Luftvereinigungen an Strassen (Factsheet for Airpollution on Roads MLuS02 Issue 2005) The RLuS 2012 Model is the updated version of the model and is recognized by the German Control Agencies and Road Planning Administration for determination of air quality alongside roads. The software has been developed in accordance with these guidelines and in accordance with European Union guidelines and requirements. It is therefore in compliance with requirements of European Agencies and Financiers.

<https://www.lohmeyer.de/de/content/softwarevertrieb/produktuebersicht/rlus>

¹¹⁰ Carbon Monoxide and Sulphur dioxide were measured in the field in 2018. Limitations in testing facilities available in Tajikistan did not allow for field measurements of other pollutants and values recommended in the RLuS2012 software were used for the landuse prevailing in the project area “rural area with low pollution levels.

¹¹¹ µm micrometer (formerly micron) equalling 1×10⁻⁶ metre

¹¹² Handbook emission factors for road transport (HBEFA) <https://hbefa.net/e/index.html> accessed May 2020

738. The ~~amount~~ quantity of emissions is dependent on traffic volume, technical condition of vehicle fleet, share of heavy vehicles, traffic speed and longitudinal gradient. Traffic forecasts for the base year 2018, and future year 2025 (after 7 years from the base year) and year 2033 (after 15 years from the base year) have been derived for the project road by the Traffic Engineers. As the RLU S 2012 model uses “real time” information to derive pollution loads it limits impact emissions to 2030 and therefore a worst case situation at 2030 has been used in the model. This is considered reasonable and as a safety factor the AADT numbers have been raised by ~20% (from 4,052 to 5000) to give a safety factor. The traffic data used for the air quality modelling exercise are shown in the traffic noise assessment section (Table 57) and replicated in Table 64 below. In the future it is expected that with the development of low pollutant vehicles the air pollution due to road traffic will in general decrease.

Table 64: Traffic forecasts in Annual Average Daily Traffic (AADT)

Year	AADT				
	Small pax	LMGVs	HGVs	TTs	Sum
2018	1,695	79	139	12	1,924
2033	3,373	263	336	80	4,052^{note1}

Note 1 – The RLU S2012 modelling exercise has assumed an AADT of 5,000 as a factor of safety

739. **Air Emission Criteria adopted:** For Tajikistan, the Law on the Protection of Atmospheric Air establishes the basic principles of the protection and rational use of the atmosphere in the country, economic mechanisms and responsibilities, as well as the directions of activity of state bodies. The Project must comply with the respective national standards and in addition with the standards of the Financing Agencies. Therefore in the Rogun bypass Project in addition to the Tajikistan standards the IFC/WB standards need to be met. In this assessment where there is deviation in standards the most stringent is adopted. Table 7 of this EIA compared environmental standards for atmospheric air. The standards adopted for the model assessment are identified in the following table.

Table 65: Air Quality Standards Applied in the Project (Annual Average Values)

Parameter	Unit	Adopted from
Carbon Monoxide CO	3.00 mg/m ³	Tajikistan Standard ¹¹³
Coarse particles PM ₁₀	0.02 / 0.07 / 0.05 / 0.03 / 0.04	IFC/WHO Guideline value / Interim Value 1 / Interim Value 2 / Interim Value 3/ EU Directive ¹¹⁴
Fine particles PM _{2.5}	0.01 / 0.035/ 0.025 / 0.015 / 0.02	IFC/WHO Guideline Value / Interim Value 1 / Interim Value 2 / Interim Value 3/ EU Directive
Nitrogen Dioxide NO ₂	0.04 mg/mm ³	IFC/WHO Guideline

¹¹³ Annex 3 to the Environmental Impact Assessment Procedure, adopted by resolution of the Government of the Republic of Tajikistan No. 464 of 3rd October 2006.

¹¹⁴ DIRECTIVE 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

Nitrogen Monoxide NO	0.06 mg/m ³	Tajikistan Standard
Sulphur Dioxide SO ₂	0.05 mg/m ³	IFC/WB Standard
Benzol C ₆ H ₅	0.005 mg/m ³	EU Standard – EU Directive on Ambient Air Quality

740. The project road crosses a relatively uninhabited mountainous upland landscape interspersed with isolated small villages. The project corridor does not have industrial sources of pollution and the main source of air pollution is from the burning of fossil fuels for heating and cooking. Other source of emissions into the atmosphere can be divided into exhaust gases from motor vehicles and dust raised by motor vehicles, though site observations in August and September revealed few motorized vehicle movements on the alignment.

741. Due to the absence of any industrial pollutant sources, air quality on the alignment is good. The main sources of emission are from fuel used for heating and cooking and very limited vehicle emissions. The pollution level is therefore very low along the whole alignment. The measured average values are below the the Maximum Permissible Concentration (MPC) in Tajikistan legislation, see Table 21.

742. **Air Quality Baseline:** A project specific air quality baseline was established at seven locations along the alignment. Data was collected in October 2018 and is presented in Table 21. Six parameters were monitored: Inorganic dust (TSP¹¹⁵); nitrogen oxides (NO₂ + NO); carbon monoxide (CO); carbon dioxide (CO₂) and sulphur dioxide (SO₂). Limited testing facilities are available in Tajikistan and did not allow for field measurements of other pollutants. Where necessary, values recommended in the RLU2012 software were used for background air quality for the landuse prevailing in the project area considered to be “rural area with low pollution levels” The locations at which the measurements were carried out are: (i) Jamoat Obigarm, Gurun village, school number 6; (ii) Jamoat Sicharog, kishlak Lugur, 200 m from the alignment; (iii) Khamimi Jamoat, Sadokat kishlak, 800 m from the alignment; (iv) Jamoat Mudzhikharf, kishlak Mudzhikharf, 300 m from the bridge under construction number 8; (v) Jamoat Komsomolobad, Tutkhor village, 150 from the alignment; (vi) Safedchashma Jamoat (Samsolik), Safedchashma kishlak; and; (vii) Darband, eastern suburbs, km 152. The locations are indicated in Figure 31.

7.4.2.2 Impacts – Results of quantitative air quality model

743. The results of the air quality emission modelling are presented in full as Annex 10 to this document. Summarised results are presented here. The results are presented as worst case levels for the project road in terms of each air quality parameter and at distances upto 200m from the road in 10m increments. Contour plots have not been prepared as the low pollution levels mean that exceedance contours lie within the road footprint and could not be understandably presented in a contour format.

744. **Carbon Monoxide (CO) modelling results:** Carbon monoxide (CO) is generated through incomplete combustion processes. Traffic emissions represent a major source of CO-emission to ambient air.

¹¹⁵ There was no opportunity to measure PM₁₀ or PM_{2.5} with equipment available in Tajikistan in October 2018 and therefore Total Suspended Particulates (TSP) has been used as an indicator of particulate levels (dust and fine airborne particles).

745. In Tajikistan $3.00 \text{ mg/m}^3 \text{ CO}^{116}$ (annual average) is the standard to be met for CO emissions and used in the modelling exercise to confirm compliance.
746. The initial pollution level was set to 0.1 mg/m^3 according to the recommendation of the used software RLU_{S2012} for rural areas with low pollution load. This is higher than the measured baseline average value for CO (0.0027 mg/m^3).³⁾ in the Project area and therefore a conservative approach.
747. The results of the modelling are presented as a figure of the worst case situation (2033) that shows the baseline together with the additional pollution load from the traffic movements. The vertical axis shows the average annual pollution load in $\mu\text{g/m}^3$ and the horizontal axis shows the distance to the road edge.
748. The additional pollution caused by traffic is $10.439 \mu\text{g/m}^3$ (0.01 mg/m^3) at the road edge and $6.325 \mu\text{g/m}^3$ (0.006 mg/m^3) at 10 m distance to the road edge. This additional pollution level is shown in green colour in the figure. The standard for CO applied in the Project is 3.00 mg/m^3 . The compliance annual average ($3000 \mu\text{g/m}^3$) is not shown in the figure because of the scale of the vertical axis. The modelled pollution level for CO is far below the standard compliance level.

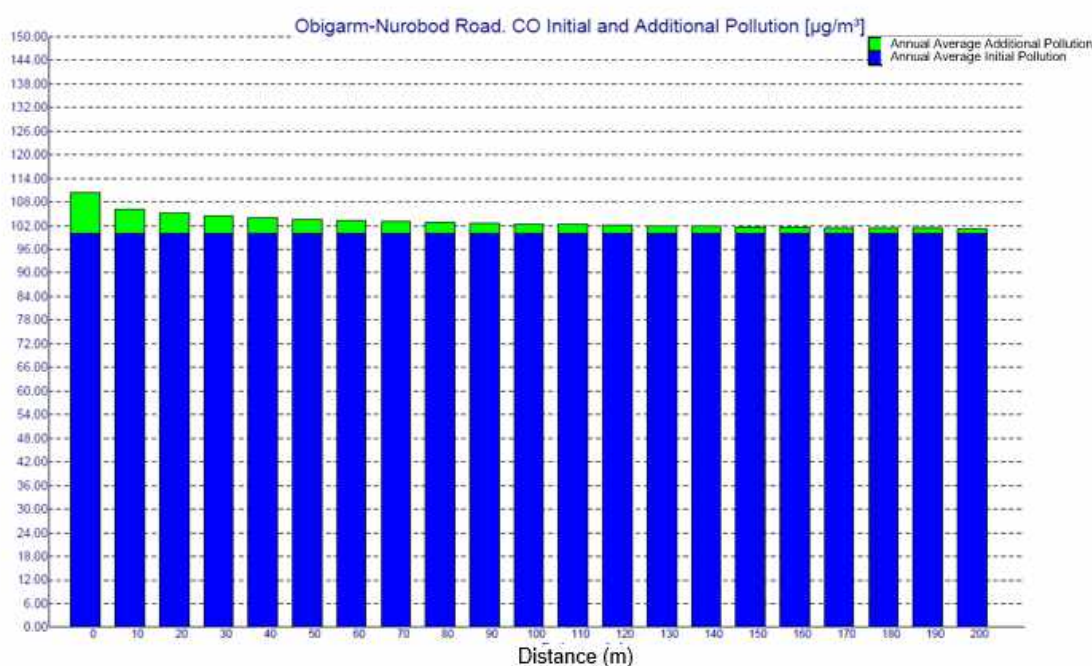


Figure 68: Worst case emission level for Carbon Monoxide (CO)

749. **Sulphur dioxide and Nitrogen Oxide (NO₂ and NO) modelling results:** The modelled additional pollution at the road edge are $0.06 \mu\text{g/m}^3$ for SO₂, $2.4 \mu\text{g/m}^3$ for NO₂ and $3.59 \mu\text{g/m}^3$ for NO. At 10 m distance to the road edge the values reduce to 0.03, 1.17 and $2.34 \mu\text{g/m}^3$ respectively.
750. The calculated total pollution load at the road edge for the three sub-stances is $6.0 \mu\text{g/m}^3$ for SO₂, $11.4 \mu\text{g/m}^3$ for NO₂ and $4.6 \mu\text{g/m}^3$ for NO. The underlying compliance standards are $2050 \mu\text{g/m}^3$ (0.0205 mg/m^3) for SO₂, $40 \mu\text{g/m}^3$ (0.04 mg/m^3) for NO₂ and $60 \mu\text{g/m}^3$ (0.06 mg/m^3) for NO. The calculated values for the Project road are well below these standards the following figures present the modelling output.

¹¹⁶ 3.00 mg/m^3 is equivalent to $3000 \mu\text{g/m}^3$

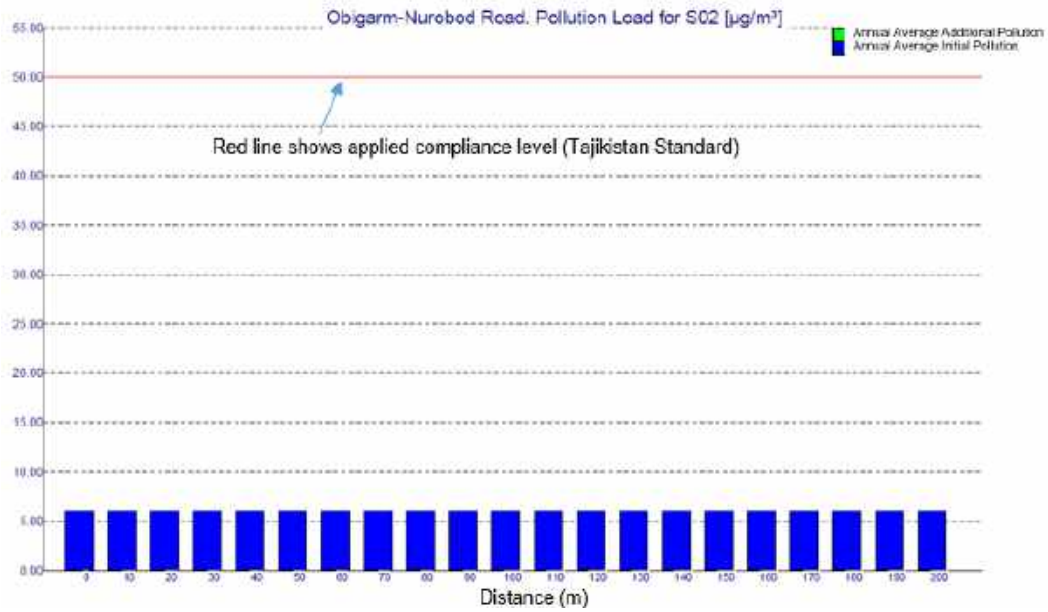


Figure 69: Worst case emission level for Sulphur Dioxide (SO₂)

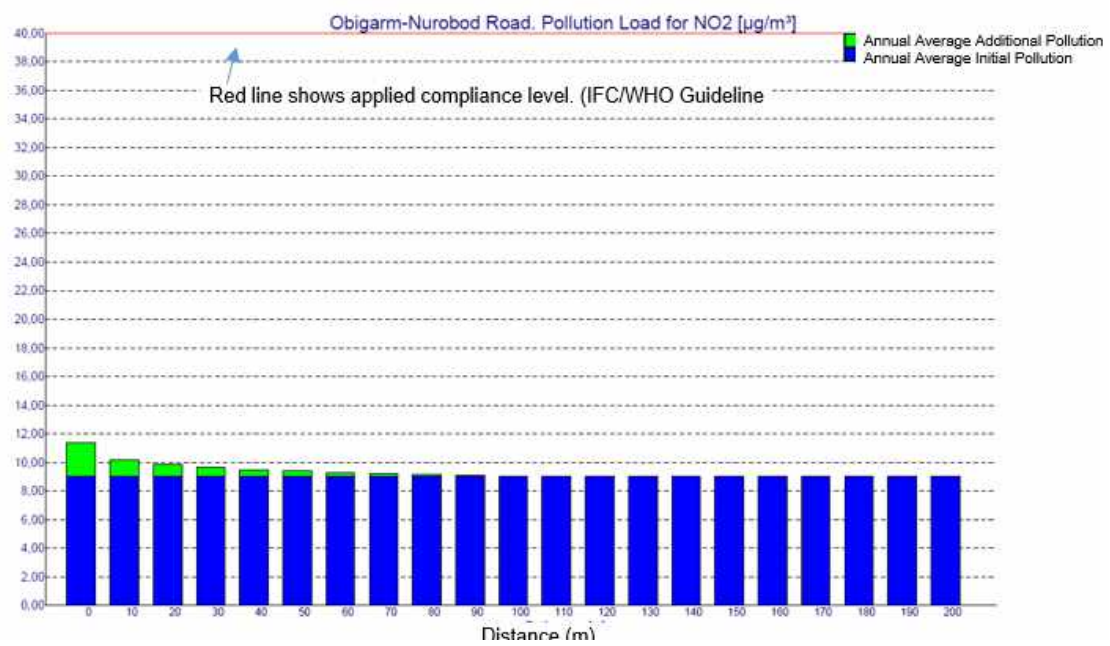


Figure 70: Worst case emission level for Nitrogen Monoxide (NO₂)

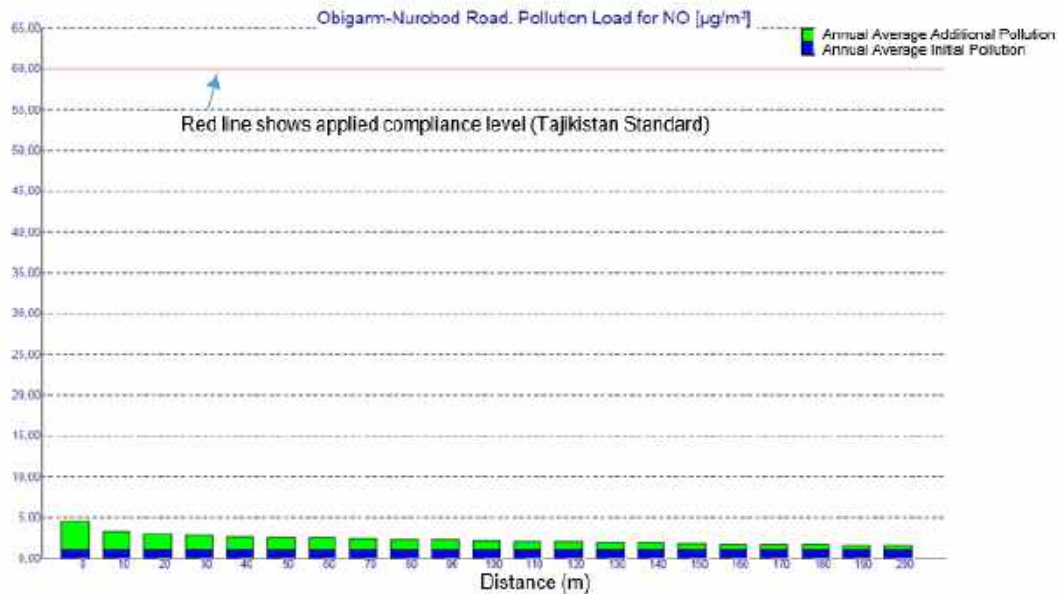


Figure 71: Worst case emission level for Nitrogen Monoxide (NO)

751. Benzol (C_6H_6) modelling results: the benzol immission alongside the Project road.

752. No baseline measurements for benzol were carried out. A background pollution level of $0.0006 \text{ mg}/\text{m}^3$ ($0.6 \mu\text{g}/\text{m}^3$) has been used suggested for low polluted rural areas by the software RLU₂₀₁₂. Figure 72 shows that operation of the alignment adds a very small impact due to the Project operation, $0.01 \mu\text{g}/\text{m}^3$ at the road edge and $0.009 \mu\text{g}/\text{m}^3$ at 10 m distance to the road edge. The applied standard according to the EU Guideline on Air Emissions is $5 \mu\text{g}/\text{m}^3$. Therefore for benzol the Project road has no significance regarding air pollution. The applied compliance level of $5 \mu\text{g}/\text{m}^3$ is not shown in the figure because of the scale of the vertical axis.

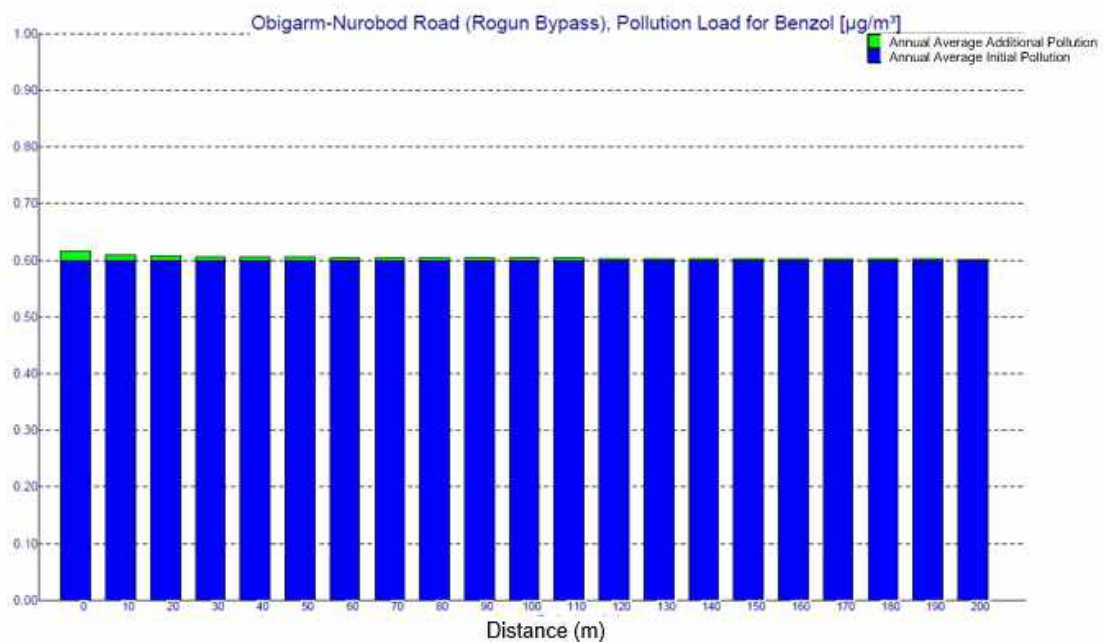


Figure 72: Worst case emission level for Benzol (C_6H_6)

753. **Particulate emissions (PM₁₀ and PM_{2.5}) modelling results:** particulates are emitted as part of the combustion process and also from friction of tyres on the road, application of brakes and wearing of couplings. Research suggests that these small particles are respirable, can be inhaled, and can penetrate deep into the lungs and blood streams unfiltered.

754. Only TSP (Total Suspended Solids) were measured in the baseline monitoring exercise as PM₁₀ and PM_{2.5} monitoring was not possible in Tajikistan with the equipment available in October 2018. TSP includes PM₁₀ and PM_{2.5} but also includes less harmful larger particles. Therefore PM₁₀ and PM_{2.5} values suggested by the software RLU_{S2012} were taken as background pollution load. The additional pollution of PM_{2.5} caused by the Project road is 0.0008 mg/m³ at the road edge and 0.0005 mg/m³ at 10 m distance. For PM₁₀ for the respective values are 0.0015 mg/m³ and 0.0009 mg/m³.

755. For PM₁₀ the applied standard is the strong IFC/WHO Guideline (µg/m³). The calculated total emission is well below this standard. The European Union Standard for PM₁₀ is 40 µg/m³. For PM_{2.5} the interim target 3 of IFC/WHO (15 µg/m³) is taken as a reference which is still well below the annual average standard of the European Union (20 µg/m³).

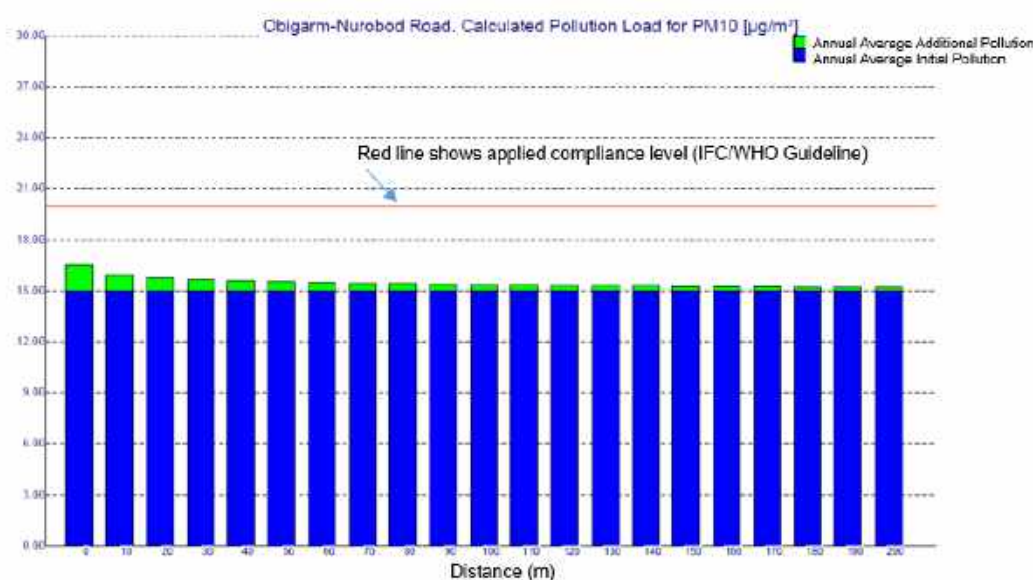


Figure 73: Worst case emission level for coarse particulates (PM₁₀)

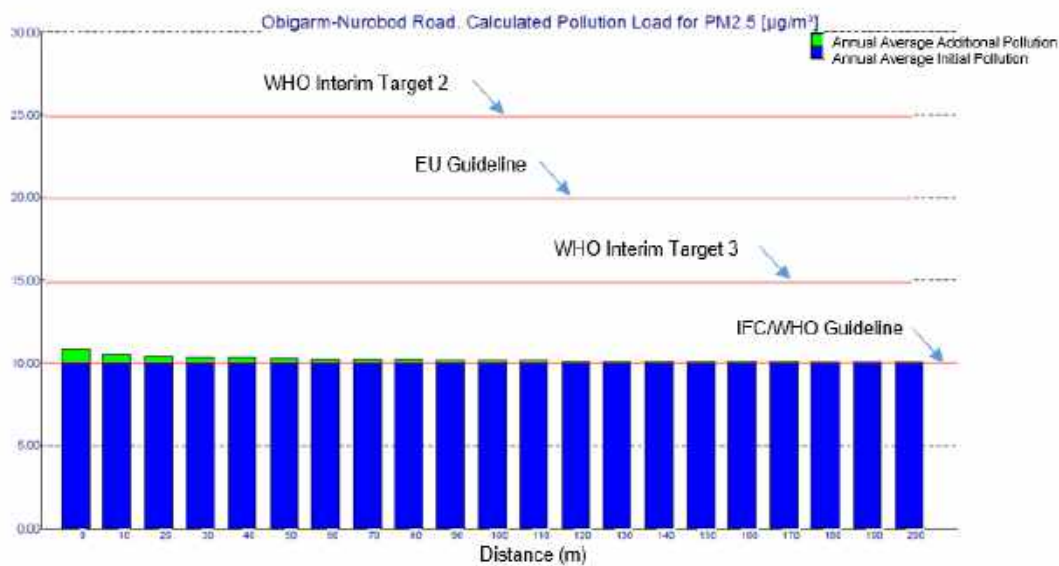


Figure 74: Worst case emission level for fine particulates (PM_{2.5})

756. Air emissions will also be generated by road maintenance activities, including dust, vehicle emissions and bitumen fumes, from the asphalt. Impacts for these activities are anticipated to be similar to construction phase emissions, but on a much reduced localised scale and lower frequency.

757. Vehicle emissions in tunnels may become concentrated if adequate ventilation is not provided and maintained.

7.4.2.3 Air Quality impacts at specific sensitive receivers

758. For better illustrating the air quality assessment results representative residential buildings were identified as sensitive receptors. The mor populated areas at the western ends and eastern ends of the alignment were selected for this assessment. The location of these- residential buildings alongside the Project road are shown in Figure 75 (at the start of the project alignment), Figure 76 (residential properties adjacent to the alignment in the Kandak settlement) and Figure 77 (residential properties adjacent to the alignment in the Gulmon settlement) (Map Source: Google Earth). For each of the identified residential buildings the initial air pollution level and the calculated total pollution level for the year 2030 are shown in Table 66, Table 67 and Table 68.

759. The initial pollution levels are extracted from table 6 in Chapter 18: Annex 9: Air Emission Assessment and the total pollution levels are extracted from table 8 in Chapter 18: Annex 9: Air Emission Assessment which provides the total emmissions alongside the Project road for the horizon year 2030 in 10 m steps starting from the road edge.

760. For buildings located between 0 and 9 meters from the road edge the modelled pollution level at the road edge is used, for buildings located between 10 and 19 meters from the road edge the modelled pollution level at 10 meter from the road edge is used, etc.

761. There is no exceedance of any of the relevant standards at the selected buildings.



Figure 75: Air quality model sensitive receivers - West End of Alignment (Km 0 – 1)

762. Three buildings were selected at the west end of the alignment. They correspond to sensitive receivers identified in the traffic noise assessment (S1/1, S1/2 and S1/ 5. The following table presents the model output for pollutants at these buildings. All are below the required air quality standard.

Table 66: Air quality model output - West End of Alignment (Km 0 – 1)

Bldg			Air Pollutants in $\mu\text{g}/\text{m}^3$								
			CO	NO	NO ₂	NO _x	SO ₂	Benzol	PM ₁₀	PM _{2.5}	BaP
		Standard	3000	60	40	---	50	5	20	35	
Bld 1	50m	Without vehicles	100.00	1.00	9.00	10.53	6.00	0.60	15.00	10.00	0.00
		With vehicles	103.61	2.54	9.38	13.28	6.02	0.61	15.53	10.30	0.00
Bld 2	50m	Without vehicles	100.00	1.00	9.00	10.53	6.00	0.60	15.00	10.00	0.00
		With vehicles	103.30	2.45	9.29	13.05	6.02	0.60	15.49	10.27	0.00
Bld3	15m	Without vehicles	100.00	1.00	9.00	10.53	6.00	0.60	15.00	10.00	0.00

		With vehicles	106.25	3.34	10.17	15.29	6.03	0.61	15.92	10.51	0.00
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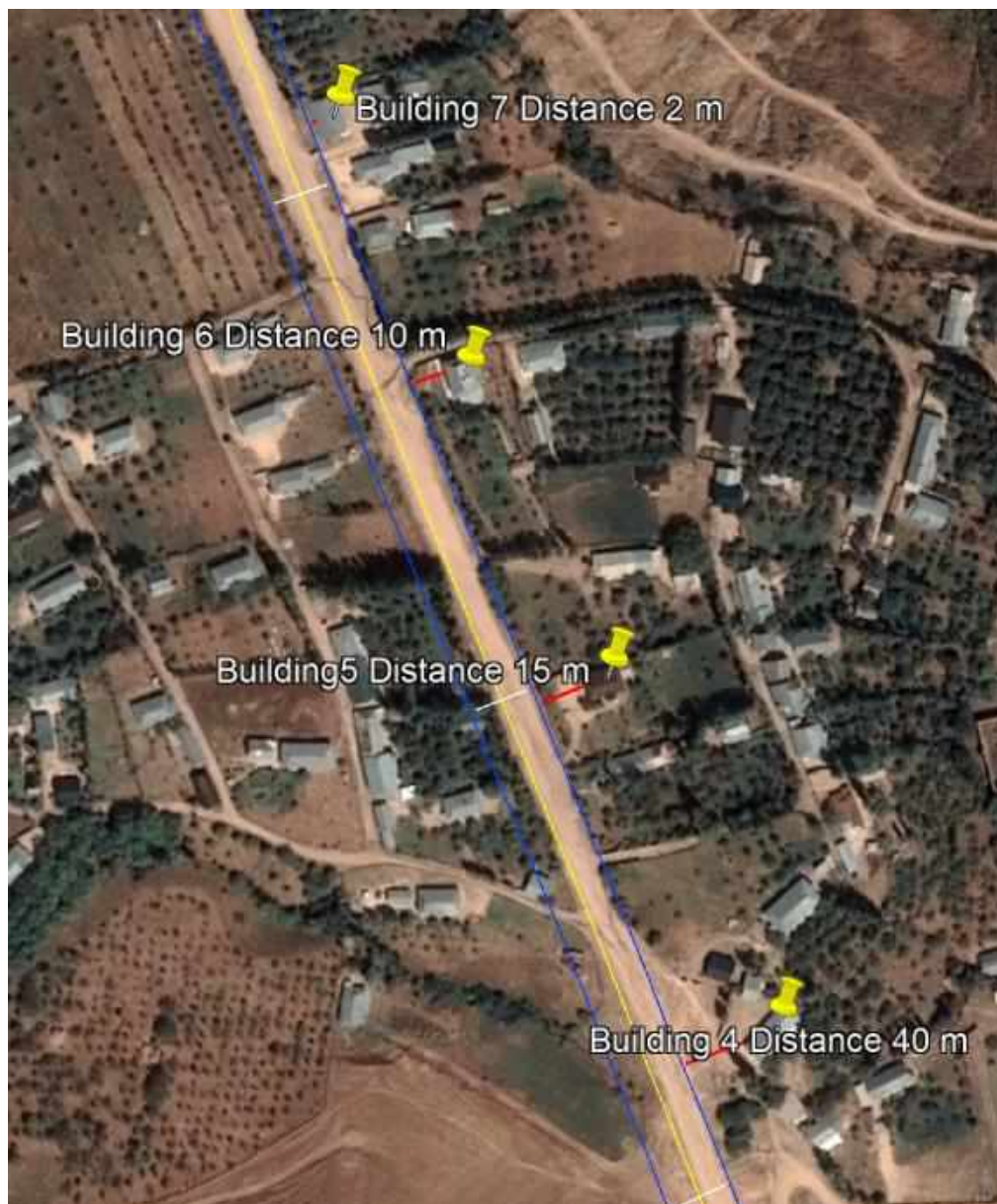


Figure 76: Air quality model sensitive receivers - Kandak settlement (Km 4.5 - km 6)

763. Four buildings were selected at the settlement of Kandak at the western end of the alignment. They correspond to sensitive receivers identified in the traffic noise assessment (Building 7 – not in noise assessment, Building 6 #S1/21, Building 5 #S1/19 and Building 4 – not in noise assessment). The following table presents the model output for air pollutants at these buildings. All are below the required air quality standard.

Table 67: Air quality model output - West End of Alignment (Km 4.5 – 6)

Buildin			Air Pollutants in $\mu\text{g}/\text{m}^3$								
			CO	NO	NO ₂	NO _x	SO ₂	Benzol	PM ₁₀	PM _{2.5}	BaP

		Standard	3000	60	40	---	50	5	20	35	
<i>Bld4 4</i>	40m	Without vehicles	100.00	1.00	9.00	10.53	6.00	0.60	15.00	10.00	0.00
		With vehicles	103.98	2.65	9.50	13.57	6.02	0.61	15.59	10.33	0.00
Bld 5	15m from edge	Without vehicles	100.00	1.00	9.00	10.53	6.00	0.60	15.00	10.00	0.00
		With vehicles	106.25	3.34	10.17	15.29	6.03	0.61	15.92	10.51	0.00
Bld 6	10m from edge	Without vehicles	100.00	1.00	9.00	10.53	6.00	0.60	15.00	10.00	0.00
		With vehicles	106.25	3.34	10.17	15.29	6.03	0.61	15.92	10.51	0.00
Bld7	2m	Without vehicles	100.00	1.00	9.00	10.53	6.00	0.60	15.00	10.00	0.00
		With vehicles	110.39	4.59	11.40	18.44	6.05	0.62	16.53	10.85	0.00



Figure 77: Air quality model sensitive receivers - East – Gulmon settlement (Km 68 - 70)

764. Four buildings were selected at the settlement of Gulmon at the eastern end of the alignment. They correspond to sensitive receivers identified in the traffic noise assessment (Building 8 #S6/61, Building 9 #S6/22, Building 10 #S6/23 and Building 11 #S/24). The following table presents the model output for air pollutants at these buildings. All are below the required air quality standard.

Table 68: Air quality model output – East End of Alignment (Km 68 – 70)

Building	From road		Air Pollutants in $\mu\text{g}/\text{m}^3$								
		Parameter	CO	NO	NO ₂	NO _x	SO ₂	Benzol	PM ₁₀	PM _{2.5}	BaP
		Standard	3000	60	40	-	50	5	20	35	-

Bld 8	10m	Initial Pollution	100.00	1.00	9.00	10.53	6.00	0.60	15.00	10.00	0.00
		Pollution Level 2030	106.25	3.34	10.17	15.29	6.03	0.61	15.92	10.51	0.00
Bld 9	10m	Initial Pollution	100.00	1.00	9.00	10.53	6.00	0.60	15.00	10.00	0.00
		Pollution Level 2030	106.25	3.34	10.17	15.29	6.03	0.61	15.92	10.51	0.00
Bld10	15m	Initial Pollution	100.00	1.00	9.00	10.53	6.00	0.60	15.00	10.00	0.00
		Pollution Level 2030	106.25	3.34	10.17	15.29	6.03	0.61	15.92	10.51	0.00
Bld11	30m	Initial Pollution	100.00	1.00	9.00	10.53	6.00	0.60	15.00	10.00	0.00
		Pollution Level 2030	104.47	2.80	9.64	13.93	6.02	0.61	15.66	10.37	0.00

7.4.2.4 Tunnel Portal emission

765. Air quality emissions are concentrated at tunnel portals and a supplementary modelling exercise was carried out for emissions at the tunnel portals. Air pollution dispersal at tunnel portals follows a different mechanisms to those on the open road alignment. A separate calculation model is integrated in the RLuS2012 air quality modelling software¹¹⁷. There are only three tunnels on the alignment, all are generally remote from residential development being at an elevated location. The following table copied from the Tunnel impact section shows number of residences within 500m and 1.0Km of the six tunnel portals.

Table 69: Air quality assessment - Developments within 500m and 1Km of tunnel portal

Tunnel	South Portal		North Portal	
	Within 500m	Within 1000m	Within 500m	Within 1000m
Kandak	Nil	Nil	Nil	21
Karagach	4	8	Nil	Nil
Tagikamar	6	>76	4	44

766. The velocity of the air exiting the tunnel is dependent on tunnel dimensions and geometry, average vehicle speed and percentage of heavy vehicles. Based on the identified tunnel dimensions (Figure 52) width of the portal was set to 13 m and the height to 10 m.

767. The model assumes a disturbed mix zone upto 50m from the portal and dispersion is calculated from this point. The software calculates the total emission (initial [baseline] pollution plus tunnel emission, plus road) from the defined emission point. For this exercise pollution was calculated in 10 metre increments from the road edge at the portal, see Figure 78.

Tunnel sketch

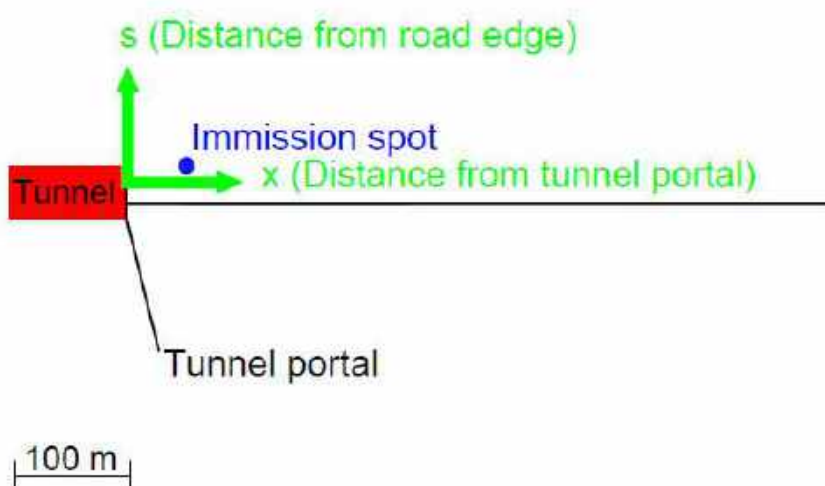


Figure 78: Tunnel Portal Emission – modeling parameters

¹¹⁷ Air quality modelling software RLuS 2012 by Lohmeyer Ltd. www.lohmeyer.de

768. Due to the low traffic flows on the alignment the predicted (calculated) pollution levels shown in Table 70 indicate that pollution levels are within the allowed criteria at the portal.

Table 70: Average Annual Pollution at Distances from Tunnel Portals

Total Annual Average Pollution Level in 10 m increments from Tunnel Portal [$\mu\text{g}/\text{m}^3$]									
Distance (m)	CO	NO	NO ₂	NO _x	SO ₂	Benzol	PM ₁₀	PM _{2.5}	BaP
Compliance Level	3000	60	40	----	50	5	20	15	----
0	163.27	10.53	17.03	33.17	6.12	0.64	18.27	12.56	0.00
10	125.18	5.03	11.83	19.54	6.05	0.62	16.30	11.02	0.00
20	111.17	3.04	9.87	14.53	6.02	0.61	15.76	10.45	0.00
30	106.01	2.80	9.64	13.93	6.02	0.61	15.66	10.37	0.00
40	104.12	2.65	9.50	13.57	6.02	0.61	15.59	10.33	0.00
50	103.61	2.54	9.38	13.28	6.02	0.61	15.53	10.00	0.00
60	103.30	2.45	9.29	13.05	6.02	0.60	15.49	10.27	0.00
70	103.07	2.37	9.21	12.85	6.01	0.60	15.45	10.25	0.00
80	103.03	2.30	9.15	12.67	6.01	0.60	15.41	10.23	0.00
90	103.02	2.24	9.08	12.52	6.01	0.60	15.38	10.21	0.00
100	103.02	2.19	9.03	12.38	6.01	0.60	15.36	10.20	0.00

7.4.2.5 Mitigation

769. Due to the low numbers of vehicles on the alignment the pollution effects from traffic emissions are very low and within applicable guideline values. Therefore no additional mitigation for the traffic operations are required upto the 2033 horizon adopted in this EIA.

770. An Operational Air Quality Management Plan will be developed and implemented by the Maintenance Department of the MoT and will include provisions for maintenance of tunnel air extraction systems and procedures to mitigate dust and emissions from road maintenance activities.

771. With these mitigation measures, the risk is assessed as “low” and the air quality effect is not considered significant.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Emissions to air from exhaust emissions from vehicles using the road and maintenance activities and vehicle exhausts	MINOR	POSSIBLE	LOW	NO

7.4.3 Operation Phase Hydrology and Water Quality

7.4.3.1 Impacts

772. The design of the road includes drainage provision. i.e. removal of rainwater / surface water run-off through drainage systems. In the villages this will be through edge drains and culverts. In the rural sections drainage will be through crossfall on the road surface.

773. Inadequate or non-timely maintenance and cleaning of the drainage network can lead to clogging and malfunction of the system, contributing to deterioration of the pavement (e.g. through water penetration and frost heave) and worsening sanitary-hygienic conditions in the road area. Road maintenance activities can result in silty run-off and oil leakage from poorly maintained maintenance machinery, stockpiled materials and asphalt, and from spilled liquids during refuelling and fuel handling. Runoff from salt application may also cause contamination of surface water runoff, if not appropriately planned and managed. Pollution of watercourses that may be used by the community and potential impacts on stream ecology is possible if not appropriately managed. These risks will be managed through the implementation of the Operational Drainage Management Plan.

7.4.3.2 Mitigation

774. An Operational Drainage Management Plan will be developed and implemented by the Maintenance Department of the MoT. The plan will set out measures to monitor and maintain drainage structures, including the culverts and pipes beneath the road that the village water pipes will pass through.

775. This plan will cross reference other sub-plans including; Emergency Response Plan, Operational Waste Management Plan, and others as required. Additionally, location specific mitigation measures will be covered by the required plans for these operations, including the Tunnel Operational Management Plan.

776. With these mitigation measures the risk is assessed as “low” and the effect is not considered significant.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Contamination of watercourses and localised flooding due to blocked drainage	MINOR	IMPROBABLE	LOW	NO

7.4.4 Operation Phase Biodiversity

7.4.4.1 Impacts

777. Current livestock movement patterns will likely be of local importance to scavenging animals, in particular birds such as black vulture and griffon vulture. The project will potentially result in changes to livestock movements, thus impacting species which rely on the associated carrion or faeces as part of their foraging regime.

778. Illegal hunting and collecting of fruit / seeds / firewood / medicinal herbs, etc., is already occurring across the project area. The project will improve local access along its extent, which poses potential risks in terms of increasing this activity. It is not considered likely that the magnitude of change in this regard will result in a significant effect. However, mitigation will be implemented to further ensure this.

779. Furthermore, the new road use will potentially impact local animal movement through an increase in vehicle collisions, in particular during the period within which animals are habituating to the operational road.

7.4.4.2 Mitigation

780. The project's potential impact on biodiversity is considered to be limited, however, mitigation measures should be adopted to ensure this. These are detailed within the project EMP, and an Operational Biodiversity Management Plan will be developed and implemented to mitigate potential impacts

781. With mitigation in place, the effect to biodiversity is considered to be not significant.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Adverse impacts on Biodiversity, flora and fauna, due to collisions, changes to livestock movement patterns and illegal poaching and seed/fruit/herb gathering.	MINOR	IMPROBABLE	LOW	NO

7.4.5 Operation Phase Waste Management

7.4.5.1 Impacts

782. Operation of the road will require periodic removal of waste accumulated from littering alongside the alignment. Improper and non-timely collection, removal and disposal of waste can lead of odour and aesthetics impacts in the road and nearby area. Waste from the road alignment will be removed during scheduled maintenance by the MoT maintenance teams, as set out in the Operational Waste Management Plan.

7.4.5.2 Mitigation

783. The Operational Waste Management Plan set outs measures to manage roadside waste, waste from maintenance activities and the tunnel offices.

784. With mitigation in place, the waste effect is considered to be not significant.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL
Removal of wastes during planned maintenance, and waste accumulation along road	MINOR	POSSIBLE	LOW

7.4.6 Operation Phase Soil Management

7.4.6.1 Impacts

785. The application of chemicals for road de-icing may impact the soil and water quality and lead to pollution, thus operation and maintenance manuals should establish the approaches for winter maintenance of the road with due consideration of environmental impacts. Though it is noted that normal practice for winter maintenance in Tajikistan is to spread earth on the snow / ice to improve surface grip.

7.4.6.2 Mitigation

786. Chemicals for road de-icing shall be chosen carefully with due consideration of environmental impacts. Maintenance programmes should include defined application rates and conditions for de-icing chemicals to minimise potential for run-off of excess into drainage and soils.

787. The MoT maintenance team will develop and implement an Operational Soil Management Plan that sets out the defined approach. With mitigation in place, no significant effect on soils is anticipated.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT
Impacts to soils from inter maintenance.	MINOR	POSSIBLE	LOW	NO

7.4.7 Climate Change - GHG Emissions Due to Operation

7.4.7.1 Impacts

788. Addressing GHG emissions is a specific requirement of the EBRD reporting process. In this section, a greenhouse gas assessment has been conducted for operational phase of the road. Emissions sources for the operational phase were included or excluded from the assessment, based on their potential to result in significant emissions. The scope of this assessment has been informed by professional judgement and is summarised in Table 71.

Table 71: Scope of Operational Greenhouse Gas (GHG) Assessment

Emissions source	PAS2080 Ref ¹¹⁸	Scope	Justification
Lighting electricity Consumption	B6	Out	Emissions from lighting are expected to have a small magnitude due to only small sections of the Project being lit
Tunnel Ventilation electricity Consumption	B6	Out	Emissions from ventilation are expected to have a small magnitude due to the ventilation system mainly being run for testing of fire suppression
Maintenance / Repair	B2-3	Out	The Project will be maintained. However, this is not expected to result in large magnitude emissions, and the control over maintenance activates only fall partially within the design team and contractor's control.
Replacement / refurbishment	B4-5	In	During the Project reference lifespan Project elements will need to be replaced. This is expected to result in large magnitude emissions.
Water Consumption	B-7	Out	Water consumption has a low carbon emissions rate, it is not expected that large quantities of water will be used to operate the Project. As such this is not expected to be a large magnitude source of emissions.
Land Use Change – Biomass growth	B-8	Out	The project is not expected to add or remove any large carbon sinks and therefore land use change emissions are not expected to be a large magnitude source of emissions.
Emissions from traffic using the local road network	D	In	Emissions from the traffic using the Project are expected to have a large magnitude.
Deconstruction emissions	C1-4	Out	Expected timescales for decommissioning are so far into the future that there is insufficient certainty about the likelihood, type or scale of emissions activity to determine their likely magnitude, even if they take place at all.

789. A range of scheme information, assumptions and emissions factors were used to calculate the magnitude of emissions from the operation of the scheme. There is a very high level of uncertainty associated with the results, due to the limited availability of

¹¹⁸ PAS2080 Refs are lifecycle reference codes used to consistently define construction Project lifecycle stages – BSI (2006) PAS2080: Carbon Management in Infrastructure
<https://shop.bsigroup.com/ProductDetail?pid=000000000030323493>

data. As such it is recommended that this assessment, and its scope, is reviewed and updated once further information is available.

Table 72: Design Information, Assumptions and Emissions Factors in GHG Assessment

Description	Data type	Value	Unit	Source
Project reference lifespan	Assumption	120	Years	Assumption
Tunnels and bridges replacements over Project reference lifespan	Assumption	0	no.	Assumption - other project examples
Road surface replacements over Project reference lifespan	Assumption	6	no.	Assumption - other project examples
Road base replacements over Project reference lifespan	Assumption	2	no.	Assumption - other project examples
Vehicle journeys	Assumption	Dushanbe - Kyrgyz Border	N/A	Assumption - as the change in emissions is required this assumption is unimportant. However, it allows for the change in emissions due to routeing to be estimated
Current distance Dushanbe - Kyrgyz Border	Scheme information	338	Km	GIS
Distance Dushanbe - Kyrgyz Border without Scheme	Scheme information	700	Km	GIS
Distance Dushanbe - Kyrgyz Border with Scheme	Scheme information	366	Km	GIS
Fewer journeys due to increased journey length without scheme	Scheme information	40	%	Annex H: Interim Economic Evaluation
Small passenger vehicles 2024	Scheme information	2267	No. per day	Annex H: Interim Economic Evaluation
Small passenger vehicles 2029	Scheme information	2996	No. per day	Annex H: Interim Economic Evaluation
Small passenger vehicles 2034	Scheme information	3474	No. per day	Annex H: Interim Economic Evaluation
Small passenger vehicles 2039	Scheme information	4027	No. per day	Annex H: Interim Economic Evaluation
Small passenger vehicles 2044	Scheme information	4668	No. per day	Annex H: Interim Economic Evaluation
Small passenger vehicles 2048	Scheme information	5254	No. per day	Annex H: Interim Economic Evaluation
Light-medium goods vehicles 2024	Scheme information	125	No. per day	Annex H: Interim Economic Evaluation
Light-medium goods vehicles 2029	Scheme information	234	No. per day	Annex H: Interim Economic Evaluation
Light-medium goods vehicles 2034	Scheme information	271	No. per day	Annex H: Interim Economic Evaluation
Light-medium goods vehicles 2039	Scheme information	314	No. per day	Annex H: Interim Economic Evaluation

Light-medium goods vehicles 2044	Scheme information	364	No. per day	Annex H: Interim Economic Evaluation
Light-medium goods vehicles 2048	Scheme information	410	No. per day	Annex H: Interim Economic Evaluation
Heavy goods vehicles 2024	Scheme information	205	No. per day	Annex H: Interim Economic Evaluation
Heavy goods vehicles 2029	Scheme information	284	No. per day	Annex H: Interim Economic Evaluation
Heavy goods vehicles 2034	Scheme information	351	No.	Annex H: Interim Economic Evaluation
Heavy goods vehicles 2039	Scheme information	433	No.	Annex H: Interim Economic Evaluation
Heavy goods vehicles 2044	Scheme information	535	No.	Annex H: Interim Economic Evaluation
Heavy goods vehicles 2048	Scheme information	633	No.	Annex H: Interim Economic Evaluation
Truck-trailers vehicles 2024	Scheme information	26	No.	Annex H: Interim Economic Evaluation
Truck-trailers vehicles 2029	Scheme information	71	No.	Annex H: Interim Economic Evaluation
Truck-trailers vehicles 2034	Scheme information	83	No.	Annex H: Interim Economic Evaluation
Truck-trailers vehicles 2039	Scheme information	96	No.	Annex H: Interim Economic Evaluation
Truck-trailers vehicles 2044	Scheme information	111	No.	Annex H: Interim Economic Evaluation
Truck-trailers vehicles 2048	Scheme information	125	No.	Annex H: Interim Economic Evaluation
Small passenger vehicles	Emissions factor	0.382	kgCo2/v.km	GHG Protocol 2017
Light-medium goods vehicles	Emissions factor	0.531	kgCo2/v.km	GHG Protocol 2017
Heavy goods vehicles	Emissions factor	1.151	kgCo2/v.km	GHG Protocol 2017
Truck-trailers vehicles	Emissions factor	1.717	kgCo2/v.km	GHG Protocol 2017

790. Using the above information and assumptions, it was possible to quantify emissions from the replacement of scheme elements over the Project's reference life span, and emissions and changes in emissions from road vehicles, either using the scheme, or diverted around the reservoir if the scheme was not in place. The results of this assessment are presented below.

Table 73: Emission quantification - from project compared with no project

Emissions from traffic average per year (D) - tCO ₂	Emissions from traffic over Project life span (D) - tCO ₂	Emissions from replacement (B4) - tCO ₂	Net - tCO ₂
-59,000	-7,098,000	276,000	-6,822,000

791. The magnitude of emissions shows that the increase in vehicle use due to the road, is more than offset by the distance reduction due to the road, resulting in avoided traffic emissions due to the Project. The magnitude of these avoided emissions is greater than the emissions due to replacing Project elements over the Project lifespan, resulting in net negative emissions due to the scheme.

792. Based on the magnitude of emissions and professional judgment it is possible to conclude on the impact of the Project on the climate during operation.

7.4.7.2 Mitigation

793. During operation, all maintenance and refurbishment of the Project will be undertaken using best-practice efficient approaches and efficient plant and equipment.

794. Based on the magnitude of emissions and professional judgment it is possible to conclude that the impact of the Project on the climate during operation will be low and the effect will not be significant.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Climate Change – Operational GHG Emissions	MINOR	PROBABLE	LOW	NO

7.4.8 Climate Change – Adaptation and Resilience of the Project

7.4.8.1 Impacts

795. Climate change and associated natural hazards is a key issue affecting road infrastructure during both construction and operation. The climate change and seismic risks to the project were assessed under separate dedicated assessments which aimed to identify material climate change related risks to the project and propose mitigating structural and non-structural improvements to increase the project's resilience. "Assessment of climate change risks to Vahdat – Kyrgyz Border Rehabilitation Project" contracted by EBRD covers the climate risks to package 2, and a Climate Risk and Vulnerability Assessment screening contracted by ADB was undertaken for package 1. The assessments identified the following relevant hazards to the project:

- Increasing ambient average temperature and temperature ranges;
- Increasing average precipitation and short-term heavy rains;
- Increase in melted water coming from higher altitudes resulting in an increase in slush flows on the road or around the road;
- Increasing average levels of wind and short-term stronger winds;
- Changes in seismicity.

7.4.8.2 Mitigation

796. Measures to mitigate these risks have been incorporated into the design documents.

797. An Operational Climate Resilience Management Plan will be developed, which will include updates on changes in physical conditions and their projections, and which will specify requirements and processes (management framework) with respect to climate resilience.

798. With mitigation in place the post mitigation risk is assessed as "medium" and it is recommended to be monitored throughout operation.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Climate change resilience	MODERATE	POSSIBLE	MEDIUM	YES

7.4.9 Operation Phase Worker Health & Safety

7.4.9.1 Impacts

799. Workers involved with operation of the road will mainly be maintenance personnel, but will also include tunnel operations staff.

800. Risks to safety can occur due to violation of proper health and safety practices and may lead to injuries and accidents.

801. Key hazards associated with maintenance activities include:

- Heavy vehicles and construction traffic
- Interaction between vehicles and pedestrians
- Excavations
- Exposure to noise, dust, vibrations and other agents
- Hazardous materials, including fuels and bitumen
- Exposure to heat, cold and extreme weather conditions
- Work in confined spaces
- Collapse of tunnels and other structures
- Electrical and other equipment
- Welfare at work locations

802. Key hazards associated with tunnel operations include:

- Interaction between vehicles and pedestrians
- Exposure to heat, cold and extreme weather conditions
- Lone working
- Welfare at work locations

7.4.9.2 Mitigation

803. The hazards from maintenance activities can be mitigated, as long as proper safety practices and procedures are robustly and competently applied. An Operational Worker Health and Safety Plan will be developed, including processes and responsibilities for mitigating the key risks described above.

804. An Operational Emergency Response Plan, including a specific plan for Tunnel Emergencies will be developed, including measures for prevention, mitigation and response to all relevant emergency scenarios (road traffic accidents, spills, fire, etc.). The plan will define the suitable response resources (medical, fire fighting, etc) necessary to mitigate the remote location of the alignment and consequent increased response times.

805. With these management plans in place, the risk is assessed as “low” and the effect is not considered significant.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?
Operational phase worker health & safety	MINOR	POSSIBLE	LOW	NO

7.4.10 Socio-Economic Impacts – Road Safety

7.4.10.1 Impacts

806. The operation of the road will bring vehicles into an environment where there was previously no vehicle movements. This will change the safety environment, resulting in

an increase risk of traffic accidents, due to an increase in the number of vehicles, particularly if they drive at high speeds. The project may change the community's exposure to risks and impacts arising from traffic accidents, and structural failures, due to this increased traffic.

807. During the operation period negative impact might occur as a result of driving at higher speed.

7.4.10.2 Mitigation

808. Many of the key mitigations measures to reducing the potential safety impacts to the public during the operation of the road, were incorporated into road design during the design phase. The designed-in safety features are summarised in Section 4.7.

809. A robust maintenance regime for roads, barriers, bridges, drainage and safety features will be developed and implemented by the MOT maintenance team, as set out in their Operational Maintenance Plan. This plan will ensure the continued effectiveness of safety measures (signage, crossings etc). A specific programme of inspection and maintenance will also be developed for the tunnels.

810. A programme of road safety audits will be conducted to assess safety performance along the alignment and village access roads, and to identify any unsafe conditions. This will include a Road Safety Audit at Pre-Opening / Post Construction to confirm that the recommendations agreed during the design stage Road Safety Audit have been implemented. A further Road Safety Audit should be undertaken 12 months post opening, and then periodically every 3 years to assess road traffic collisions along the road and identify any trends / accident blackspots that required safety improvement actions.

811. An Operational Community, Health and Safety Management Plan will be developed by the PIURR and will include monitoring of the effectiveness of safety measures, ongoing consultation with the community (with reference to the Stakeholder Engagement Plan).

812. Community road safety awareness will be enhanced, and information on any safety issues raised by the community will be obtained, though the engagement of the CLO, who will liaise with the local community as required by the SEP. Various initiatives will be carried out during operation to raise awareness or road safety and other aspects within the local community, particularly the safety awareness of local women and children. Such initiatives have been identified within the Operational Community Health and Safety Management Plan. Furthermore, a GRM will be developed and implemented for the Project so community and maintenance / tunnel workers concerns can be raised, addressed and closed out by the Contractor.

813. The Emergency Response Plan, including a tunnel specific section, will set out measures for prevention, mitigation and response to all relevant emergency scenarios (road traffic accidents, spills, fire, etc.). It will be implemented and enforced to ensure timely and adequate reaction in case of emergencies affecting road users (both vehicles and pedestrians) and the wider community.

814. With these management plans in place, and the proposed support initiatives by the IFIs in relation to road safety, the risk is assessed as "low" and the effect is not considered significant.

RISK	RISK SEVERITY	RISK LIKELIHOOD	POST MITIGATION RISK LEVEL	SIGNIFICANT?

Operational phase community health & safety	MINOR	POSSIBLE	LOW	NO
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7.4.11 Other Socio-Economic Impacts -- Livelihood.

7.4.11.1 Impacts

815. The impacts on population and employment are anticipated to be generally positive, providing improved access to jobs and services. The project will create limited job opportunities for the local population (both men and women), during the operation / maintenance phases. Additionally, there may be commercial opportunities associated with improved access to markets, either due to easier transportation of goods and people, or through trading activities along the alignment

816. The project will improve the reliability, safety and speed of passengers and goods transportation along the alignment. Additionally, it will reduce the potential for transport interruptions, and provide a route to replace the highway inundated by the Rogun Dam, and will provide a connection to Kyrgystan.

7.4.11.2 Mitigation

817. The PIURR and maintenance team will be required to consider employing local men and women, where possible.

818. The parking areas in the villages are expected to provide opportunities to sell local produce to road users.

819. The road itself will provide faster access to markets, reducing the risk of fresh produce deteriorating during transport to markets. It will also provide access to employment opportunities and education establishments.

820. The road is anticipated to result in a significant positive effect on local employment and livelihood.

RISK	RISK SEVERITY	RISK LIKELIHOOD	RISK LEVEL	SIGNIFICANT?
Operational impacts on employment and livelihood	MAJOR	POSSIBLE	HIGH (POSITIVE)	YES

8 Environmental Management Plan

8.1 Objectives, Structure and Content

821. The objectives of the Environmental Management Plan (EMP), including the Monitoring Plan, are:

- To ensure project components are conducted in compliance with the national laws and regulations as well as the requirements of the Asian Development Bank (ADB), European Bank for Reconstruction and Development (EBRD), Organisation of the Petroleum Exporting Countries (OPEC) Fund for International Development (OFID) and the Asian Infrastructure Investment Bank (AIIB) (the Lenders);
- To measure the success of proposed mitigation measures in minimising and/or reducing potential environmental, health, safety and social impacts;
- To continuously control the changes to baseline environmental, health, safety and social conditions during pre-construction, construction and operation activities;
- To facilitate a continual review of activities based on performance data and consultation feedback; and
- To implement corrective actions or new adaptive management programs, as required.

8.2 Lenders Requirements

822. The project is being financed by the lenders as follows:

- **Package 1** will be financed by USD 110 million grant from ADB and USD 40 million loan from OPEC Fund for International Development. Package 1 consists of the following sections of the Road:
 - Section 1 - Javoni – Kandak
 - Section 2 - Gazakyon – Sebnok (Lugur);
 - Section 3 - Hakimi – Siyohgulak;
 - Bridge No 1 through Bridge No 6
 - Tunnel No 1 (Kandak Tunnel); and
 - Tunnel No 2 (Karagach Tunnel)ending short of the south portal of Tunnel No 3 (Tagikamar Tunnel).
- **Package 2** will be financed by USD 150 million loan from European Bank for Reconstruction and Development (EBRD). Package 2 consists of the following sections of the Road from 33 km:
 - Section 4 - Mudzhiharv-Alihodzha;
 - Section 5 - Alihodzha – Tuthor;
 - Section 6 - Tuthor – Kabudiyon (Samsolik);
 - Section 7 - Kaboudiyon – Humdon
 - Bridge No 7 through Bridge No 13;
 - Tunnel No 3 (Tagikamar Tunnel); and
 - The temporary bridge over the Surhkhob River at Darband,.
- **Package 3** will be financed by USD 40 million loan from Asian Infrastructure Investment Bank (AIIB) and covers the long permanent bridge (760 m) over the Rogun HPP Reservoir at Darband over the Surhkhob River.

823. This EMP has been developed for all packages, in accordance with all the Lenders' requirements. The Site Specific Environmental Management Plan (SEMP) and sub-plans set out in this EMP, will be developed by the Contractor in accordance with the relevant Lenders' requirements, at a contract level.

824. The Lenders' requirements are described below.

825. EBRD – Performance Requirements (PRs)

- **PR 1: Assessment and Management of Environmental and Social Impacts and Issues**
 - *Establishes the importance of integrated assessment to identify project-specific environmental and social impacts and the requirement to implement an Environmental and Social Management System (ESMS) to effectively manage these impacts.*
- **PR 2: Labour and Working Conditions**
 - *Outlines the need to respect and protect the fundamental principles and rights of workers.*
- **PR 3: Resource Efficiency and Pollution Prevention and Control**
 - *Sets out how resource efficiency and pollution prevention and control are essential elements of environmental and social sustainability and that projects must meet Good International Practice (GIP).*
- **PR 4: Health and Safety**
 - *Outlines the need to protect and promote the health and safety of workers by ensuring healthy and safe working conditions and requires the implementation a project-specific health and safety management system.*
- **PR 5: Land Acquisition, Involuntary Resettlement and Economic Displacement**
 - *Recognises the need to avoid, or when unavoidable, minimise involuntary resettlement by exploring alternative project designs. This PR also outlines the need to minimise adverse social and economic impacts from land acquisition or restrictions on affected persons' use of and access to assets and land.*
- **PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources**
 - *To project and conserve biodiversity using a precautionary approach, implementing the mitigation hierarchy and promoting GIP.*
- **PR 8: Cultural Heritage**
 - *Recognises the importance of cultural heritage for present and future generations. The aim is to protect cultural heritage and to guide clients in avoiding or mitigating adverse impacts on cultural heritage in the course of their business operations.*
- **PR 10: Information Disclosure and Stakeholder Engagement**
 - *Recognises the importance of open and transparent engagement between the client and their stakeholders, in particular local communities directly affected by the project.*
- PR 7 (Indigenous Peoples) and PR 9 (Financial Intermediaries) are not applicable to this project.

826. ADB – Safeguard Requirements

- Safeguard Requirements 1: Environment; and
- Safeguard Requirements 2: Involuntary Resettlement.
- Noting that Safeguard Requirements 3: Indigenous Peoples, is not applicable to this project.

827. AIIB – Environmental and Social Standards (ESS)

- ESS 1: Environmental and Social Assessment and Management; and
- ESS 2: Involuntary Resettlement.

- Noting that ESS3: Indigenous Peoples, is not applicable to this project

8.3 Roles and Responsibilities

828. The following roles and responsibilities have been established for implementation and management of this EMP.

- **PIURR**

The PIURR, as Project implementing authority (IA) will be responsible for ensuring the compliance with and implementation of all national and international environmental, health, safety and social policies, guidelines and performance requirements of both the Republic of Tajikistan and IFIs (ADB, OFID, EBRD and AIIB) involved in the Project alignment.

The PIURR will be responsible for the overall implementation of the mitigation measures and requirements specified within the EIA disclosure package for the Project. They will be required to oversee implementation of the SEMP developed by the contractor to ensure it fulfils all identified environmental, health, safety and social requirements under the loan agreement for the Project. The PIURR are responsible for ensuring roles and responsibilities are clearly identified and allocated for environmental, health, safety and social, gender, both within the PIURR itself, within the contractors' arrangements and for the handover to operations. The PIURR will also be responsible for the implementation of the Environmental and Social Action Plan (ESAP) agreed with the EBRD.

In relation to land acquisition and resettlement, the PIURR will be responsible for the full implementation of the Land Acquisition Resettlement Plan (LARP) following approval by IFIs and the Government of Tajikistan. In addition, the PIURR will be responsible for the implementation and conformance of the grievance redress mechanism (GRM) to ensure that all grievances and/or objections (if any raised by the local community and/or workers) are received, acknowledged and addressed as per the grievance procedure presented in the Stakeholder Engagement Plan (SEP) and LARPs for each of the three Package.

A Community Liaison Officer (CLO) shall also be appointed by the PIURR to manage consultations and implement the developed Stakeholder Engagement Plan (SEP) with local communities.

Monitoring of environmental quality and of the implementation of mitigation measures will be performed by the Construction Supervision Consultant (CSC) with sufficient TORs and staff-time for this task. Therefore, as a minimum, it is required for CSC to recruit 3 months of a Senior International Environmental Specialist and full time for a National Environmental specialist over 3 years during the project implementation. In addition, a Senior International Occupational Health and Safety Specialist will be employed for 4 months during the project duration and a National Occupational Health and Safety Specialist full time (18 months) during the implementation of the project under the CSC Contract. Within the PIURR a National Environmental Monitor will be employed half time (18 months) to provide support to the PIURR officers in monitoring environmental performance of the project.

- **Supervising Engineer**

The Supervising Engineer will be responsible for supervising the Contractor to ensure that recommendations and requirements, as set out in this EMP and other documentation are applied. They will be responsible for continuous monitoring of the

processes and activities undertaken by the Contractor, and specifying measures to be implemented by the Contractor, to address any areas of non-compliance

- **Lenders Technical Advisor**

The Lenders will appoint a Technical Advisor who will be responsible for reviewing documentation on behalf of the lenders (ADB, OFID, EBRD and AIIB), and who will monitor the Contractor's implementation of the activities specified in the EMP on a quarterly basis. They will be responsible for providing a monitoring report to the Lenders that evaluates compliance with both the EMP and Lenders requirements, and providing recommendations to the Supervising Engineer and Contractor to address any areas of non-compliance.

- **Contractor**

The Contractor will be responsible for implementing the EMP and the Environmental and Social Management System (ESMS) in line with Lender Requirements.

The Contractor is also responsible for implementing any environmental, health, safety and social measures identified in the National EIA, that the PIURR has developed for submission to the Committee for Environmental Protection (CEP).

The Contractor will be responsible for submission of relevant reports to the Supervising Engineer, for subsequent approval by the Supervising Engineer, PIURR and/or the Committee for Environmental Protection (CEP), as appropriate.

The Contractor must ensure the EMP is implemented by competent individuals, using approved methods of monitoring, and calibrated equipment (field testers and hand-held equipment) where appropriate. Calibration must be done regularly. All calibration records and monitoring results, along with the copies of the site records, certificates, permits and documents shall be submitted and kept by the Project Implementation Unit Road Rehabilitation (PIURR).

The Contractor shall appoint a dedicated Environmental and Safety Officer (ESO) and Deputy Environmental and Safety Officer (DESO) responsible for undertaking health, safety and environmental management tasks as set out in the Contract and lead the monitoring team. These personnel will be supported by additional personnel with specific EHS responsibilities. The Environmental and Safety team will report directly to the contractor's Project Manager.

The responsibilities of the ESO will include:

- Ensuring the contractor implements the environmental protection and management specifications set out in the Contract and the SEMP;
- Undertaking day-to-day environmental and safety management tasks as required for the Project and weekly environmental audits;
- Maintaining a daily Site Diary recording all relevant matters concerning environmental and safety management on the Site including protections and controls, audits, inspections, and related incidents. Making the Site Diary available for inspection by the Engineer upon request;
- Participating in joint inspections to be undertaken by PIURR, ADB and other environmental organisations and the Engineer's environmental team; and
- Preparing and submitting the reports as required by the Contract and the SEMP.

The Contractor shall also appoint a dedicated person with responsibilities for managing the requirements of the Contract and EMP related to social and gender matters.

On site support from an experienced consultant specialising in health and safety, providing additional support and advice, and building the capacity of the Contractor will be engaged. The consultants will assist the Contractors in developing, implementing and monitoring the Health and Safety Plan. Other safety, environmental and/or social specialists may be engaged to provide support as necessary.

- **PIU Consultant**

A special Project Implementation Unit (PIU) will be established within PIURR and will be dedicated to the management of the EBRD financed Section 2 as well as other components included in the EBRD's technical assistance program (PIU Section 2). The PIU Consultant will facilitate the timely and effective implementation of the Project by providing assistance to the Client with respect to the following:

- Assistance with the establishment of the PIU;
- Assistance with procurement, tendering and contract implementation;
- Assistance with compliance & reporting obligations under the financing documents;
- Environmental and social implementation support;
- Assistance with asset management, including support in development of an operations and maintenance manual for effective asset management and routine maintenance;
- Support with climate change adaptation including development of a Climate Resilience Management Plan (CRMP).

8.4 Environmental Management System (EMS)

829. The Contractor will be responsible for implementing an EMS that is in line with International Standards. The Contractor will be required to appoint appropriately qualified specialists with the following expertise, to ensure the EMS is implemented to the required standards:

- Environmental;
- Health and safety;
- Social (including gender and stakeholder engagement); and
- Land acquisition and resettlement.

830. The EMS, will include a Social Risk Register, which the Contractor will be responsible for updating at least monthly throughout the pre-construction and construction period, and more frequently when required. This will utilise information from the community and health review, (in EMP).

831. The Contractor must conduct an initial environmental, safety and social induction course for construction workers regarding health and safety measures, emergency response in case of accidents, fire, earthquakes, landslides, flash flooding, environmental and community interactions, grievance procedures etc. They must also develop and implement an environmental, health and safety and security (EHSS) training program, and conduct EHSS meetings on a monthly basis with the PIURR.

8.5 Environmental Reporting Requirements

832. The Contractor will produce monthly and quarterly reports and these must include information on environmental performance. Reporting will include but not be limited to:

- Status of the EMP;
- Status of any other contractor prepared environmental and social documents
- Status of environmental, safety and labour permits (e.g. asphalt plant, borrow areas if appropriate)

- Recording any environmental, health and safety and social (EHSS) monitoring results (e.g. air, noise, water quality, vibration audits / inspections)
- Results of contractor and joint contractor / CSC site audits
- Grievance redress mechanism
- Interaction with the public – public consultations and complaints
- Training of site staff in EHSS matters

833. The PIURR will prepare a six monthly Environmental Monitoring Report drawing on the Contractors monthly and quarterly environmental monitoring information and reporting the Environmental and Social Performance of the project. This document will be disclosed on the ADB project website

8.6 Pre-Construction and Construction Phase EMP

834. An overarching Environmental Management Plan has been developed for the construction phase of the Project. This identifies the need for a Contractor generated Site Specific Environmental Management Plan (SEMP), and supporting sub-plans to manage specific issues or activities. The relationships between these plans is presented in Figure 79 and the EMP generated through this document are presented in subsequent sections. The process of plan development is illustrated in Figure 79

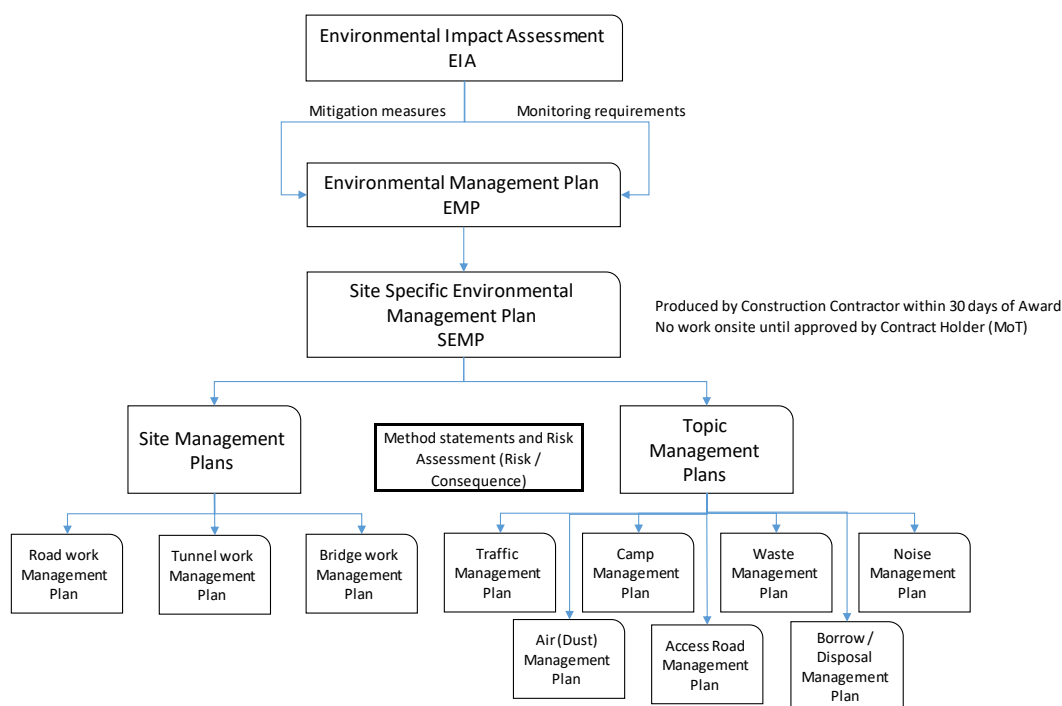


Figure 79: How a Contractor SEMP evolves from the EIA and EMP

Table 74 sets out a contents list that could be considered when developing a SEMP and Table 75 identifies all of the sub-plans identified in this EIA that should be included in the SEMP.

Table 74: Provisional Contents list for a SEMP and guidance notes on provisions

Main Headings	Sub headings	Guidance notes on section contents
INTRODUCTION		A brief description describing the purpose of the document. This section may include the Company environmental Policy.
ENVIRONMENTAL POLICY		The Contractor organization policy / principles on environmental protection designed to minimize the negative effects of its activities on the environment and community.
MANAGEMENT RESPONSIBILITIES		Including: (i) an organization showing the interactions between the different members of the site team from the Project Manager (or Similar) through the site supervisors / engineers, foremen, surveyors and the labour force. The Environmental team must report directly to the Project Manager, not through site supervisors / engineers. (ii) Job descriptions setting out the role and responsibility of each post in terms of environmental and social safeguards (iii) Emergency contact numbers and procedures – including contacts in the local community
PROJECT DESCRIPTION		To confirm the Contractor understanding of the extent of their environmental and social safeguard responsibilities
	Project Area	Demarcating construction camps, manufacturing areas, works areas, laydowns, spoil disposal sites, etc and sensitive uses including villages, springs and water courses susceptible to impact from the works.
	Project Details	Must include suitably detailed location plans for construction camps, Site offices (administration) , Manufacturing areas, Material Storage and Laydown Area. The plans must identify elements such as canteens, ablution blocks, drainage layouts, septic tanks, waste management (disposal bins)
TRAINING		Specific training that will be given to site personnel
	PPE	The correct use of PPE
	Spills	How to deal with spills
	Waste Management	Including reuse and recycling and waste separation
	AIDS / HIV	

	Cultural (Code of Conduct)	Particularly for expatriate staff on acceptance / understanding of national cultural differences and fraternization
RELEVANT LEGISLATION		Extracted from relevant sections of EIA
ENVIRONMENTAL MANAGEMENT PLANS		The specific plans for environmental management that have been identified in the EMP of the EIA
ENVIRONMENTAL MONITORING & REPORTING		Listing the environmental and social safeguards reports that the contractor will be producing during the project. EIA identifies monthly and quarterly reports (EIA section 8.5)
	Instrumental Monitoring	Identifying environmental monitoring that will be carried out
	Site audits and checklists	Identifying the site and activity specific forms the Contractor will use to confirm compliance with environmental requirements
	Public Consultation Schedule	How the Contractor will set up and manage a formal set of meetings with the community and any ad hoc meetings
Grievance Redress Mechanism (GRM)		<ul style="list-style-type: none"> (i) How complaints will be dealt with at site level identifying who is responsible and how a complaint is escalated through the stakeholders (preferably with a flow chart). (ii) Complaints hotline (iii) Community notice board with contacts

Note that this table is presented for guidance only. It is the Contractor responsibility to produce a SEMP based on their own site activities (working methods) that will achieve the necessary compliance with environmental obligations in the Construction contract.

Table 75: All of the sub plans for the SEMP identified in this EIA document

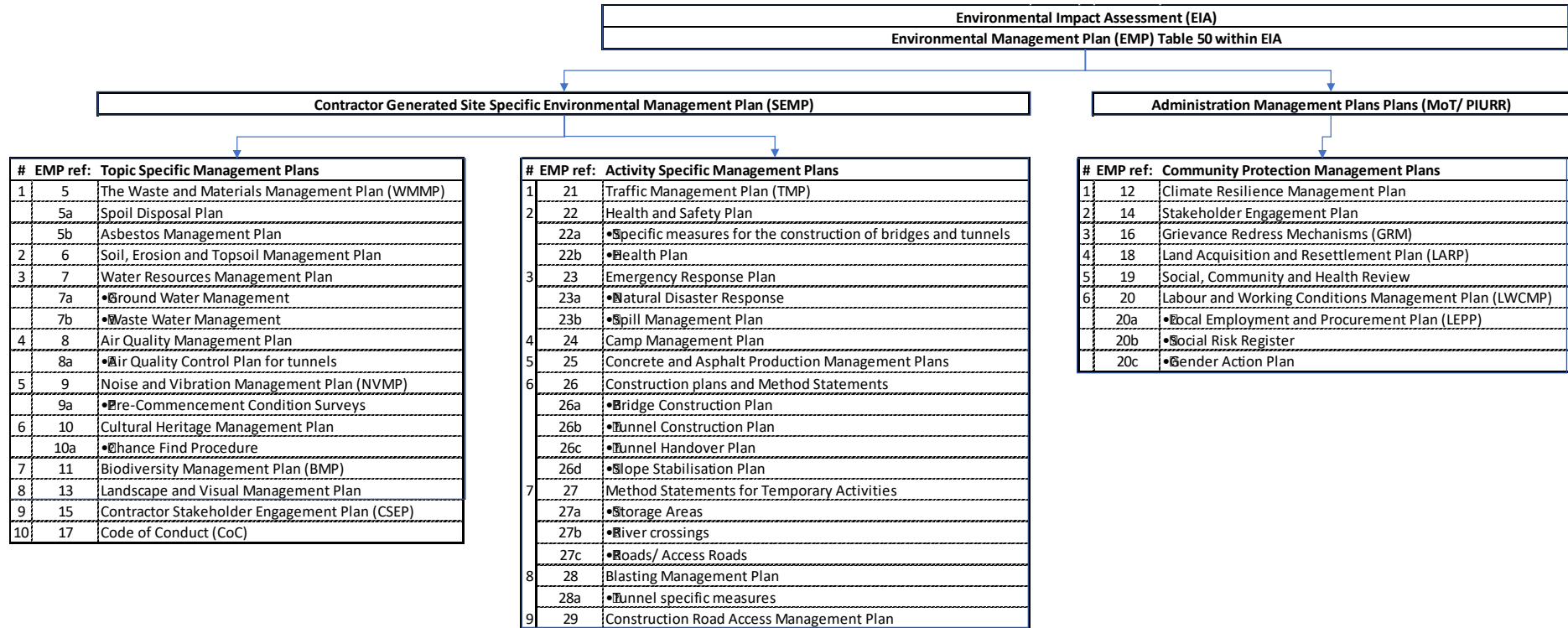


Table 76: Environmental Management Plan – Pre-construction and Construction stage

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
Overall Contractor generated Site Specific Environmental Management Plan (SEMP)					
1	Development of a Contractor generated Site Specific Environmental Management Plan (SEMP)	<p>The Contractor shall prepare a SEMP (A suggested Table of Contents for a SEMP is presented in Table 74 of this EIA). The SEMP will</p> <ul style="list-style-type: none">describe the precise location of the required mitigation / monitoring, the persons responsible for the mitigation / monitoring, and the schedule and reporting methodology.define the boundaries of the Project and all works will have to be completed within them. Marker posts will outline these boundaries within the Project area.include all of the sub-plans listed below unless these works are not scheduled to start until a later date (see specific sub-plans for details) <p>The SEMP will be submitted to the Engineer and PIURR for approval at least 30 days before taking possession of any work site. No access to the site will be allowed until the SEMP is approved by the Supervising Engineer, and the PIURR. New topic specific or site specific ESMPs may also need to be developed by the Contractor during the construction phase. These new plans will also need to be approved by the Supervising Engineer, and the PIURR.</p> <p>The Contractor will implement a ESMS in line with national and international EHSS Standards.</p> <p>The SEMP will include a review of the capacity of local emergency services.</p> <p>The Contractor will also prepare a Social Risk Register, which will include any specific plans/programmes required as a result of the Community and Health Review.</p>	<p>Preparation: Contractor’s Environmental and Social Experts (ESE)</p> <p>Approval: Supervising Engineer PIURR</p>	PIURR/Supervising Engineer.	<p>SEMP approved by PIURR/Supervising Engineer</p> <p>PR1, PR10</p>

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
2	Development of sub-plans	<p>Prior to start of site works, the Contractor shall prepare the following plans in line with the Lenders environmental and social requirements (a hierarchy of subplans is peresnted in Table 75 of the EIA):</p> <ul style="list-style-type: none">• Waste and Materials Management Plan (WMMP), including:<ul style="list-style-type: none">○ Spoil Disposal Plan○ Asbestos Management Plan• Soil, Erosion and Topsoil Management Plan• Water Resources Management Plan, including:<ul style="list-style-type: none">○ Ground Water Management○ Waste Water Management• Air Quality Management Plan (AQMP), including:<ul style="list-style-type: none">○ Air Quality Control Plan for tunnels• Noise and Vibration Management Plan (NVMP), including:<ul style="list-style-type: none">○ Pre-Commencement Condition Surveys• Cultural Heritage Management Plan, including:<ul style="list-style-type: none">○ Chance Find Procedure• Biodiversity Management Plan (BMP), including:<ul style="list-style-type: none">○ Land Restoration Plan○ Climate – Management Plan• Construction Climate Resilience Management Plan• Landscape and Visual Management Plan• Contractor Stakeholder Engagement Plan (CSEP), including:<ul style="list-style-type: none">○ Grievance Redress Mechanisms (GRM)	Preparation: Contractor Approval: Supervising Engineer and PIURR	Supervising Engineer/PIURR and CEP (where appropriate)	Plans approved as part of the SEMP by relevant parties PR 1, PR2, PR3, PR4, PR6, PR8

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">• Code of Conduct (CoC)• Land Acquisition and Resettlement Plan• Social Community and Health Review and Health Plan• Labour and Working Conditions Management Plan (LWCMP), including:<ul style="list-style-type: none">○ Local Employment and Procurement Plan (LEPP)○ Gender Action Plan (GAP)○ Social Risk Register• Traffic Management Plan (TMP)• Health and Safety Plan, including:<ul style="list-style-type: none">○ Specific measures for the construction of bridges and tunnels• Emergency Response Plan, including:<ul style="list-style-type: none">○ Natural Disaster Response Plan○ Spill Management Plan• Camp Management Plan• Concrete and Asphalt Production Management Plans• Construction plans and Method Statements, including:<ul style="list-style-type: none">○ Bridge Construction Plan○ Tunnel Construction Plan○ Tunnel Handover Plan○ Slope Stabilisation Plan• Method Statements for Temporary Activities, including:<ul style="list-style-type: none">○ Storage Areas○ River crossings			

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">○ Roads / Access Roads● Blasting Management Plan, including:<ul style="list-style-type: none">○ Tunnel specific measures			
3	Obtaining licences, permits and agreement	<ul style="list-style-type: none">● All necessary licences and permits must relation to environmental, safety and labour must be obtained prior to starting the activity that they apply to.● A database tracking all permits and consents shall be developed and maintained.● If the Contractor decides to run an asphalt production facility, then this must be discussed and agreed with the CEP. A screening exercise may be required.● If the Contractor decides to establish its own quarry or borrow pit – an appropriate licence must be obtained from the CEP. Otherwise material must be purchased from licenced providers.● Maximum allowable concentration of substances discharged into the surface water body must be agreed with (approved by) the CEP.<ul style="list-style-type: none">○ Volume of water abstraction, and sources, must be agreed with the CEP.	Implementation: Contractor Approval: PIURR CEP	PIURR, CEP Information – included in reports to the Lenders	Copies of licences, permits and agreements. PR1, PR3, PR4, PR5, PR6
4	Sub-contractors	The Contractor shall ensure that: <ul style="list-style-type: none">● Provisions will be incorporated into all subcontracts to ensure the compliance with lender requirements, Tajik legislation and the SEMP and its associated sub-plans at all tiers of the sub-contracting.● All environmental, social and safety requirements for the Contractor will apply to the sub- contractors. This will be secured via contracts. It is the responsibility of the Contractor to audit sub-contractors and ensure compliance.	Supervision Engineer/ PIURR	All plans and contracts approved by the relevant parties. Information – included in reports to the Lenders.	Copies of sub-contractor agreements. PR1, PR3, PR4

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">All Project sub-contractors will be supplied with copies of the SEMP, and sub plans.All relevant requirements of the SEMP and sub-plans must be communicated to sub-contractors.All subcontractors will be required to appoint a safety representative who will be available on the Site throughout the operational period of the respective subcontract, unless the Supervision Engineers approval for the Contractor’s safety representative to undertake take this role, is given in writing.			
Environmental Management Sub-Plans					
5	Waste and Materials Management Plan (WMMP) Including – <ul style="list-style-type: none">Spoil Disposal PlanAsbestos Management Plan	<p>The Waste and Materials Management Plan (WMMP) shall;</p> <ul style="list-style-type: none">utilise the waste hierarchy¹¹⁹ to prevent or reduce the generation of waste where possible,describe waste streams and estimated amounts of each,separate hazardous, non-hazardous and reusable waste streams.describe recycling/reuse methods for each material,identify the waste destinations and transport modes, including what materials are being segregated on site for reuse or recycling,specify responsibilities for managing and disposal of waste,describe special measures for material use and handling, <p>The WMMP will identify the location of any borrow-pits required by the project, including the volumes required and the locations that the materials will be used.</p>	Preparation: Contractor Approval: Supervision Engineer, PIURR	PIURR/ Supervising Engineer. Information – included in reports to the Lenders	Plan approved as part of the SEMP by relevant parties. PR1, PR2, PR3

119 Waste prevention→Reuse→Recycling→Other recovery→Disposal

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<p>The plan will describe communication and training to support and encourage participation from everyone on site.</p> <p>The plan will set out the following requirements:</p> <ul style="list-style-type: none">• Prior to commencement, the Contractor will need to confirm disposal procedures for non-hazardous waste, including: obtaining the required permits, securing agreements with any waste companies, and establishing management processes.• Prior to commencement of works, agreement(s) with company / companies authorised for utilisation or disposal of hazardous waste must be signed. If none are available, measures for the selection of suitable sites, and processes for the safe disposal of hazardous waste must be set out and implemented.• Agreements with waste management companies must be kept active.• The contractor is responsible for auditing all waste companies, they have agreement with, and reviewing their documentation and working practices, including environmental and safety performance twice per year.• The Construction Camp Management Plan must include waste disposal measures, including:<ul style="list-style-type: none">○ the regular collection and disposal of household waste.○ Provide bins and facilities within the project site for temporary storage of all waste streams. These facilities should be designed to prevent the escape of litter, liquids, odours or other contaminants / nuisance emissions.○ Train staff in best practice for waste minimisation and management. <p>A Spoil Disposal Plan will be developed based on site specific topo-geodetic, geotechnical, hydrological data, environmental and social data. The plan shall include:</p> <ul style="list-style-type: none">• information on location and layout of the spoil disposal areas (dimensions, slope angle) with 3D view and cross sections;			

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">• surface water runoff management and bank protection measures;• land rehabilitation and re-cultivation measures;• designation of suitable transport routes and schedule for spoil truck movements to minimise traffic disruption/ congestion, and• environmental mitigation measures to minimise impacts during transport, storage and disposal of spoil, including using covering truck. <p>Each site will be subject to a screening process (Elements for a screening process are identified in Table 53 of this EIA)</p> <p>The spoil disposal plan must be developed in association with a biodiversity specialist and the Forestry State Department. The plan must specify spoil dewatering procedures (and facilities), as necessary, and describe mitigation measures to ensure adequate treatment of wastewater prior to disposal.</p> <p>An asbestos management plan will be developed that describes processes for the identification of asbestos and for management and safe disposal of any asbestos containing materials found during construction works.</p> <p>Asbestos is prohibited from being used at any stage during the project. Any existing material that maybe present will be managed to minimise the potential environmental, health and social risks.</p> <p>General requirements include:</p> <ul style="list-style-type: none">• Do not break asbestos/asbestos containing articles when dry.• Equip staff handling asbestos with protection clothing, goggles, respirators, rubber boots.• Place material in thick, durable plastic bags. Wrap the bags and mark with asbestos warning mark.			

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">Engage specialist contractor for removal-disposal of asbestos/asbestos containing material to a licensed waste management facility			
6	Soil, Erosion and Topsoil Management Plan	<p>The Soil, Erosion and Topsoil Management Plan shall describe</p> <ul style="list-style-type: none">topsoil stripping procedures and rules,topsoil stripping depth and volumes,topsoil stripping supervision,transportation and stockpiling requirements,stockpile location,topsoil stockpile design,stockpile management,erosion hazard and erosion control,runoff drainage/diversion,soil protection measures at the storage area, maintenance of the stockpile; andtopsoil application procedure. <p>The following measures shall be applied by the Contractor:</p> <ul style="list-style-type: none">Unwanted materials from topsoil such as roots of trees, rubble and waste removed prior to stockpiling.Stockpiles of removed topsoil must be properly designed/shaped and managed, – stability of the stockpile will be achieved through preservation of ‘safe’ slope inclination and diversion of surface water runoff from the area. Soil stabilisation Best Management Practices such as mulch, soil binders, plastic sheeting or erosion control blankets must be used to protect bare soil.To ensure stability, the soil piles shall not be higher than 2 meters, with a slope gradient of less than 25%. The piles must be placed and managed so as to avoid	<p>Preparation: Contractor</p> <p>Approval: Engineer, PIURR</p>	PIURR/ Supervising Engineer.	<p>Plan approved as part of the SEMP by relevant parties.</p> <p>PR1, PR2, PR3, PR6</p>

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<p>erosion and washing off. Drainage trenches must be established to divert surface runoff from the site.</p> <ul style="list-style-type: none">• Soil compaction will be reduced by strictly keeping to temporary roads, construction camp/construction area boundaries.• Embankments and slopes with disturbed vegetation must be replanted immediately after the construction/disturbance stops, and before it rains – or if not covered with gabion baskets, fibre rolls, gravel bags or plastic sheets. Native species must be used for any replanting, fibre mats should be used to encourage vegetation growth and temporary fencing used to protect plants from being grazed.• Contractor will confine operation of heavy equipment within the area of works to avoid soil compaction and damage to privately owned land. If private lands are disturbed, the contractor should promptly inform the owner and agree on the ways to remedy the situation. <p>Measures to prevent soil contamination due to accidental spills are set out in the Water Resources Management Plan (Section 7).</p>			
7	Water Resources Management Plan Including; <ul style="list-style-type: none">• Ground Water Management• Waste Water Management	<p>The Water Resources Management Plan must provide details on predicted waste water (sewage) volumes, disposal scheme, information on capacity and type of waste water treatment facility, location of the discharge point/points with indication of coordinates. A discharge permit will be sought from the CEP and Maximum Allowable Discharge Limits (MADLs) will be set which the project must then comply with.</p> <p>The plan will include calculations of the predicted water demand for construction including water required for:</p> <ul style="list-style-type: none">• Construction (e.g. concrete mixing);• Dust suppression;• Cleaning equipment;	Preparation: Contractor Approval: Engineer and PIURR,	PIURR/ Supervising Engineer. Information – included in reports to the Lenders.	Plan approved as part of the SEMP by relevant parties. PR1, PR2, PR3

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">• Potable water for construction workers; and• Use in construction camps. <p>The plan should include measures to minimise water usage in the first instance, and also opportunities for reuse of water where possible.</p> <p>The Contractor will undertake a capacity study of available water resources along the alignment, including the location and quality of water resources used by the villages, to identify suitable resources, with sufficient availability to avoid any impact on the availability of resource to communities and businesses along the alignment. If existing groundwater or surface water resources are not appropriate (quantity or quality), alternative sources of water will be identified by the Contractor, to ensure the available resources used by the local communities are maintained at all times, including rapid provision of alternative temporary supplies in the event of disruption to usual supply.</p> <p>A review and audit of all water pipes along the route will be undertaken prior to commencement of works, to identify all existing water sources used by the communities near the alignment.</p> <p>Pipes/ culverts will be included within the design of the road, at the location of existing water resources. This will ensure that local villagers will not need to cross the new road to access water. The local communities will be consulted to inform the audit results and ensure that all the proposed new pipes/ culverts are in the correct locations.</p> <p>The Contractor will liaise with the community to understand seasonal water demand constraints, and periods of high water volumes / increased erosion.</p> <p>Water abstraction should be designed in accordance with the requirements of the Biodiversity Management Plan to minimise impacts to habitats reliant upon surface and ground water.</p>			

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<p>Works should be performed with due consideration of environmental protection:</p> <ul style="list-style-type: none">• All temporary fuel tank and storage areas must be located at least 100 m away from any surface water body and outside any flood plain.• Any temporary fuel tanks (if contractor requires small stock of fuel on the site) shall be placed in a secured, covered area with berms or dikes to contain any spills. Capacity of containment must be 110% of capacity of the tank. Any spill shall be immediately contained and cleaned up with absorbent material as per the Spill Management Plan.• Discharge of any untreated water into the surface water body must be strictly prohibited. Treated water discharge must comply with International Finance Corporation (IFC) and EU standards for effluent discharge, as well as national standards and any licence / permit requirements.• Discharge of cement contaminated water must be avoided as cement pollution results in high alkalinity and raises the pH, which can be toxic to aquatic life.• Washing out concrete trucks at construction sites will be prohibited unless specific concrete washout areas are provided for this purpose at the construction site (e.g. a bridge site). The washouts will be impermeable and emptied when 75% full. The removal of water will be in line with the requirements of the Water Resources Management Plan (Section 6).• Runoff control measures can be installed at the time of road/highway construction to reduce runoff pollution.• To prevent runoff contamination, paving should be performed only in dry weather.• In disturbed soil areas silt fence, fibre rolls (biodegradable logs), gravel bags, or other approved sediment control must be ensured. At a minimum, bare soil (whether it is an abutment slope or a stockpile) must be protected before it rains.			

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<p>Soil stabilisation Best Management Practices such as mulch, soil binders, plastic sheeting or erosion control blankets must be used to protect bare soil.</p> <ul style="list-style-type: none">• Store materials in suitable containers, with clear legible labels. The same applies to containers for short term storage of used oil.• Ensure availability of spill clean-up materials (e.g., spill kits, etc.) in the areas where accidental spills may occur.• Prohibit discharge of any untreated potentially contaminated effluents.• Provide septic tanks for the camp sites servicing less than 150 employees. Contract authorised company to remove the liquid waste regularly. For larger sites, primary treatment in anaerobic tank or pond preceded by a bar screen to remove large solid objects will be required.• All camp sewage treatment plants will be managed in accordance with manufacturer’s instructions by competent personnel, and discharges regularly monitored. If discharges cannot be treated to an acceptable standard, liquid wastes must be removed by an authorised company and disposed in an environmentally responsible manner in accordance with the Waste & Materials Management Plan. Septic tanks necessary at construction camp(s) shall be made of impermeable material and will be emptied regularly in accordance with applicable rules. Treatment sludges and the contents of any septic tanks must also be removed by an authorised company and disposed in an environmentally responsible manner..• Surface water bodies/ rivers will only be crossed via bridges. <p>Ensure that liquid wastes are removed by an authorised company and disposed in an environmentally responsible manner in accordance with the Waste & Materials Management Plan. Keep an ongoing contract with authorised company responsible for</p>			

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		removal of the liquid waste. If the camp is equipped with a sewage treatment plant this must be operated and maintained according to manufacturer’s instructions			
8	Air Quality Management Plan (AQMP) Including Air Quality Control Plan for tunnels	<p>The Air Quality Management Plan shall provide details of mitigation measures, specific location and schedule where such measures shall be implemented to minimise impacts to sensitive receptors due to the presence of the camp, construction works, sourcing and transport of construction materials, and other project-related activities.</p> <p>Prior to commencement of works, likely emissions from crushers, concrete production facilities and other emissions generating activities must be calculated and agreed with the CEP. A separate plan/schedule for air quality control in the tunnel must be provided.</p> <p>Mitigation measures will include:</p> <ul style="list-style-type: none">• Ensure all machinery and vehicles are maintained to minimise exhaust emissions. Vehicles and equipment that emit smoke will not be used and if they can’t be fixed shall be removed from the project.• Undertake immediate repairs of any malfunctioning construction vehicles and equipment.• Use construction equipment and vehicles that meet national emission standards.• Wherever possible, use electrically-powered equipment rather than gas or diesel-powered equipment.• Use fuel efficient machinery.• Ensure that all diesel and petrol running machinery use is equipped with catalytic convertors.• Position any stationary emission sources (e.g., portable diesel generators, compressors, etc.) as far as is practical from sensitive receptors.	Preparation: Contractor Approval: Engineer, PIURR	PIURR/ Supervising Engineer. Information – included in reports to the Lenders	Plan approved as part of the SEMP by relevant parties. PR1, PR3, PR4, PR6

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">• Locate support facilities and spoil disposal sites to reduce trip numbers and travel distance – as far as feasible.• Provide truck-washing facilities at tunnel portals and at safe distance from bridge construction sites to prevent track-out of mud and dust.• Implement a regular vehicle maintenance and repair program, utilising the manufacturer recommended maintenance programs.• All trucks used for transporting materials to and from the site will be covered with canvas tarpaulins.• Carry out watering for dust control at least 3 times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25°C, or in windy weather. Avoid overwatering as this may make the surrounding muddy.• Ensure compliance with the Water Resources Management Plan, including maintenance of resources used by the local communities are maintained at all times, including rapid provision of alternative temporary supplies in the event of disruption to usual supply.• Earthwork operations to be suspended when the wind speed exceeds 20 km/h (based on on-site monitoring) in areas within 500 m of any community.• Provide vegetation planting along roadsides to stabilise soils and reduce air quality impacts.			
9	Noise and Vibration Management Plan (NVMP) Including	Under the Noise and Vibration Management Plan (NVMP), as per the EIA, undertake condition surveys no later than 28 days before the commencement of construction works. The NVMP will set out the process for this. The Contractor and the Engineer will carry out joint condition surveys of all buildings within 25 metres of the road alignment that, in the opinion of the Engineer, might be affected by vibration resulting from the	Preparation: Contractor Approval: Engineer, PIURR	PIURR/ Supervising Engineer. Information – included in reports to the Lenders.	Plan approved as part of the SEMP by relevant parties. PR1, PR3, PR4

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
	Pre-Commencement Condition Surveys	<p>Contractor’s construction operations. The surveys shall be conducted in the presence of and with the permission of the property owners.</p> <p>The findings of the building condition surveys shall be recorded in the reports and will contain the following information, as a minimum:</p> <ul style="list-style-type: none">• Building address and location;• A description of the building condition and any cosmetic and/or structural damage;• Sketches and photographs showing the location and extent of any damage;• High resolution video recordings of the surveyed buildings; and• Verification of the report by the building owner. <p>The NVMP will set out the need to undertake further refined noise modelling to determine the specification and precise locations of the proposed noise barriers.</p> <p>The NVMP shall provide details of mitigation measures, specific location and schedule where such measures shall be implemented to minimise impacts to sensitive receptors due to the presence of the camp, construction works, sourcing and transport of construction materials, and other project-related activities.</p> <p>Mitigation to include:</p> <ul style="list-style-type: none">• • Use well maintained construction equipment and vehicles.• • Use construction equipment and vehicles fitted with appropriate noise suppression. Fit all pneumatic tools with an effective silencer on their air exhaust port.• • Use temporary noise barriers while working in sensitive locations if allowable noise limits are expected to be exceeded.• • Impose speed limits on the project vehicles to minimise noise emission while moving along/across the sensitive areas.			

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">• Keep to no horn policy unless vitally necessary.• As much as possible, use quiet equipment and working method: e.g. Diesel hammer piling – substituted with drill piling or hydraulic piling.• Whenever possible: enclose noisy equipment, restrict non- stop operation of noisy equipment, avoid simultaneous operation of noise generating equipment.• Consider seasons sensitive for birds and other wildlife while planning noise-generating works, with cross reference to the biodiversity management plan.• Train staff in best practice for noise reduction and mitigation.• Inform community on schedule and duration of construction activities, particularly where these are likely to generate high noise levels.• Implement 24-hour community complaints hotline.• Limit truck speed - not to exceed 40 km/h, when driving through communities, and not to exceed 80 km/h when driving on highways.• Time and Activity Constraints, i.e., operations will be scheduled to coincide with periods when people are least likely to be affected; construction work hours and work days will be limited to less noise-sensitive times. Hours-of-work will be approved by the Engineer having due regard for possible noise disturbance to the local residents or other activities.• Construction activities will be strictly prohibited between 10 PM and 6 AM near residential areas. When operating close to sensitive areas (within 250 m) such as residential, nursery, or medical facilities, the Contractor’s hours of working shall be limited to 8 AM to 6 PM.• Noise protection kits such as ear plugs, earmuffs, will be provided for workers who are working in areas where noise levels are higher than 80 dB(A), and made			

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Pre-construction and Construction					
		<p>available to all workers on request, regardless of noise level. Mandatory use of hearing protection will be required at noise levels over 85 dB(A)</p> <p>The plan shall detail the procedures for noise and vibration surveys, monitoring and control. Such details shall include;</p> <ul style="list-style-type: none">• procedures to complete condition surveys.• Measurement locations and methods;• Method statements for works likely to induce noise and vibrations, including programs of trial construction sections to determine the likely magnitude of noise and vibrations at defined distances from the vibration source, in sufficient detail for the contractor to develop a final method for constructing the works without excessive vibration;• Description of the instrumentation and equipment to be used;• Copies of the instruction manuals and the laboratory calibration and test equipment certification;• The resumes of the vibration monitoring technical support. <p>The Contractor must respond to any noise and vibration grievances and implement remediation measures as soon as practical in line with the SEP and GRM.</p>			
10	Cultural Heritage Management Plan Including – Chance Find Procedure	<p>The Cultural Heritage Plan will include details of identified cultural heritage within the project construction area (including location maps) and describe measures to prevent impacts on these locations / items.</p> <p>Monitoring of vibration effects adjacent to sensitive receptors such as mosques will be undertaken in accordance with the Noise & Vibration Management Plan.</p> <p>The boundaries of the worksite will be strictly observed.</p>	Preparation: Contractor Approval: Engineer, PIURR	PIURR/ Supervising Engineer Information – included in reports to the Lenders.	Plan approved as part of the SEMP by relevant. PR1, PR8

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		The Plan will include induction training for workers on chance finds the plan will include a chance finds Procedure, detailing the actions to be taken if buried archaeology or other heritage items are discovered during construction activities. This will include immediate stoppage of works and notification of the Ministry of Culture and/or other relevant authority. Works would only be allowed to proceed in accordance with any instructions from the authorities.			
11	Biodiversity Management Plan (BMP)	<p>The Contractor will develop a Biodiversity Management Plan covering actions to safeguard, conservation of biodiversity on the influence territories or specific sites that tend to be affected due to the planned activity. Compliance with the plan will be responsibility of Contractor and an Ecological Clerks or Works CoW.</p> <p>The plan will set out the requirement to</p> <ul style="list-style-type: none">hire a suitable number of suitably qualified Ecological Clerks or Works (ECoW) to both map and clear the route, and approve that the route is approved as clear of biodiversity constraints, in advance of construction works.They should include identification of areas of greatest ecological value, features/species needing translocation, bird nesting areas where schedules need to be altered, etc. Their responsibility will include both surveys to inform the development of additional mitigation (if required) such as bat surveys and other species-specific surveys, and surveys to help ensure that specific mitigation is applied within the project Right of Way (RoW) in advance of vegetation clearance. <p>Actions to include in the BMP include:</p> <ul style="list-style-type: none">Mark and keep to the boundaries of the project area and the temporary sites.Replace trees where lost as part of the Project (5 to 1 replacement ratio).	<p>BMP Preparation: Contractor</p> <p>Contractor to hire Ecological Clerk of Works.</p> <p>BMP Approval: Engineer, PIURR, ADB, AIIB, EBRD</p>	<p>BMP: PIURR/ Supervising Engineer. Information – included in reports to the Lenders.</p>	<p>BMP Plan approved as part of the SEMP by relevant parties.</p> <p>Annual reporting on BMP actions / monitoring outcomes.</p> <p>ECOW approval reports that alignments have been checked and cleared prior to access</p> <p>Training Records</p> <p>PR1, PR2, PR3, PR4, PR6</p>

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">• No removal of vegetation outside the mentioned boundaries.• Prohibit shortcuts by workers, pedestrians and vehicles to avoid impact on the vegetation.• Reinstate disturbed sites immediately after completion of works.• Restore vegetated areas with diverse plants/seed mix of local/regional provenance.• Prohibit use of herbicides/chemical during vegetation clearance.• Brief the staff in vegetation protection issues during site induction.• Brief staff in relation to biosecurity measures (in particular invasive species). <p>The BMP will also include specific actions to be implemented through the lifetime of the project to further enhancement of biodiversity in the area. These actions will have associated monitoring commitments to ensure long-term effectiveness/relevance.</p> <ul style="list-style-type: none">• Use low wattage lamps directing light downwards.• Preserve vegetation in the areas outside the boundaries of the project sites.• Adhere to no horn policy to avoid disturbance of wildlife.• Impose speed limits on the project vehicles to minimise risk of road kills.• Fence trenches or pits to avoid entrapping and injuries of the fauna species. Bright coloured ribbons may be used for big animals (e.g. cattle), while metal plastic and other shields/fences may be used for small animals.• Upon completion of the shift put planks or medium size twigs in the trenches to allow small animals to escape.• Check pits and trenches prior to filling up.• Unless advised otherwise by a ECoW, tree-felling should be timed to avoid bat roosting and bird nesting seasons. Where a tree is identified as having the potential to support such features, felling/removal should only take place between mid-July and mid-September. In case bat roosts are found, arrangement of bat boxes can be			

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Pre-construction and Construction					
		<p>considered as mitigation measure. Implement tree felling/house demolition works from late September till mid-November to avoid impact on bats and breeding birds (nesting/hatching).</p> <ul style="list-style-type: none">Where relevant, implement monitoring of water quality (visual detection of turbidity increase, analysis - upstream and downstream the worksite).Implement mitigation measures set for preservation of water quality and bank erosion (soil stability).Where there are permanent and temporary ponds, efforts will be made to maintain them during the breeding season. The measures to prevent construction works extending beyond the construction boundary are anticipated to prevent disturbance to ponds outside the construction area.All staff to comply with Code of Conduct. <p>The BMP will be linked to the Landscape Management Plan, with regards to land restoration and selection of suitable species.</p>			
12	Climate – Resilience Management Plan	<p>The Climate Resilience Management Plan will ensure an appropriate mechanism for management of climate resilience risks, particularly those associated with adverse impacts of temporary works on permanent works during construction.</p> <p>Ensure:</p> <ul style="list-style-type: none">compliance with the to ensure that the temporary works (e.g. access roads) do not decrease climate resilience of permanent works as contained in the tender specificationthat surfacing materials are adequately specified accounting for anticipated climate change.that the drainage system has sufficient capacity for intense rainfall events.that the Road is protected against slope instabilities	Engineer/ PIURR	PIURR/ Technical Advisor for ADB/ EBRD / AIIB	<p>Confirmation of resilience.</p> <p>PR1, PR3, PR4</p>

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			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">that substructures and foundations have sufficient resistance to changes in ground parametersthat expansion joints have sufficient margin for anticipated climate change.that bearings have sufficient margin for anticipated climate changethat surfacing materials are adequately specifiedthat elements can be replaced at a later date but more resilience componentsthat the bridges allow for high wind loading			
13	Landscape and Visual Management Plan	<p>The Landscape and Visual Management Plan will outline the need to.</p> <ul style="list-style-type: none">Use low wattage lamps directing light downwards at work sites and camps.Ensure all lighting related to construction activities shall be shielded or directed to restrict any direct illumination onto property located outside of the Project Site boundaries. <p>All construction site lighting shall be turned off when construction activities have ceased for the day.</p> <p>In the design, the designers will:</p> <ul style="list-style-type: none">Avoid using non-native plant species.Replace trees where lost as part of the Project (5 to 1 replacement ratio).Ensure new lighting does not result in light spill/ light pollution.Choose colours of above ground sections of new buildings and at tunnel exits so they merge with environment.Give priority to use of geotextile against shotcrete.Use irregular shape stones for rubble.Avoid use of white concrete.Use full horizontal cut off glass lens luminaires, installed at 0o uplift.	Preparation: Contractor Approval: Supervising Engineer, PIURR	PIURR/ Supervising Engineer. Information – included in reports to the Lenders.	<p>Plan approved as part of the SEMP by relevant parties.</p> PR1, PR2, PR6

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			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">Where possible use lower lamp heights, provided it does not compromise safety aspects, such as the need to see road signs. <p>To prevent future pollution issues, it is recommended that the use of sodium light bulbs is prohibited and that Light Emitting Diode (LED) lights are installed with a “neutral” colour temperature of 4000K.</p>			
Community Liaison, Labour and Safety Management Sub Plans					
14	Disclosure of project information and community consultation Stakeholder Engagement Plan	<ul style="list-style-type: none">Implement the Stakeholder Engagement Plan (SEP) and organise regular consultation activities with local communities.A Community Liaison Officer (CLO) shall be appointed to manage consultations and implement the developed Stakeholder Engagement Plan (SEP) with local communities.Organise consultation events for men, women and children and disclose information about the construction impacts, health and safety, scheduling and timeframes.Conduct a meaningful consultation with the affected vulnerable groups to identify a best solution to improve their livelihood; or provide an alternative living area for them.Focus groups are preferred methods for engagement with this group. Separate males and females focus group discussions should be conducted. In particular, women must be consulted on construction and road safety, and given fair and equal representation of women in decision-making situations and greater awareness of road safety from a perspective.Data to be collected on construction and road safety from a gender perspective in the region and results communicated.	Project Implementation Unit (PIURR), Project Management and Supervision Consultant, if appointed The project design team if available	Committee for Environmental Protection (CEP), Technical Advisor for ADB, OFID, EBRD and AIIB	PR10

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Pre-construction and Construction					
		<ul style="list-style-type: none">Develop outreach and campaign promoting gender-responsive road safety. This includes focusing on risks for women and children through an enhanced approach to safety inclusive of security dimensions and understanding masculinities and men’s behaviours in relation to road safety so as to better target potential campaigns.Provide regular updates on the Project website and at Project milestones. If required, engage the media in disseminating Project information and manage public relations in case of NGO interest.Update SEP on annual basis throughout the Project as per PR10.			
15	Contractor Stakeholder Engagement Plan (CSEP)	<p>Prior to start of site works, the Contractor shall:</p> <ul style="list-style-type: none">Develop and maintain a contractor SEP (CSEP) aligned with the overarching Project SEP and train workers in the grievance mechanism requirements;establish and communicate a grievance redress mechanism (GRM), as described in the EIA disclosure package, to communities in the project impact zone, building on the GRM in the SEP;set-up and publicise a 24-hour hotline for complaints;ensure that names and contact numbers of CLOs within the PIURR, Jamoats, villages and within the PIURR contractors organisation are placed on the notice boards outside the construction site; complete on-going consultation with men, women and children during construction; andKeep a log of all complaints received. <p>The plan will outline the need to repair community facilities if damaged as a result of the works as soon as practicable.</p> <p>Contractor SEP to be updated on annual basis throughout the Project as per PR10.</p>	Preparation: Contractor Approval- PIURR, Supervising Engineer.	PIURR, Technical Advisor for ADB, EBRD, AIIB Information – included in reports to the Lenders.	GRM Established. 24-Hour hotline established and operational. Notice boards located at construction sites. Consultation completed with the identified stakeholders as per the SEP and CSEP.

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
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Pre-construction and Construction					
16	Grievance Redress Mechanisms (GRM)	<p>Prior to start of works, the Contractor shall:</p> <ul style="list-style-type: none">Establish and communicate a Grievance Redress Mechanisms (GRM), as described in the EIA and their own CSEP, to communities in the project impact zone and to their worker and sub-contractors.Set-up and publicise a 24-hour hotline for complaintsEnsure that names, genders and contact numbers of representatives of the PIURR and contractors are placed on the notice boards outside the construction site.	PIURR responsible for Contractor	Technical Advisor for ADB, EBRD, AIIB PIURR Information – included in reports to the Lenders.	<p>GRM Established.</p> <p>24-Hour hotline established and operational.</p> <p>Notice boards located at construction sites.</p> <p>Consultation completed with the identified stakeholders per the SEP.</p> PR10
17	Code of Conduct (CoC)	<p>The Contractor shall prepare a code of conduct that enshrines the commitment of the project to meet Lenders employment and labour standards. Environmental and social protection and anti-bribery and corruption controls.</p> <p>Ensure measures outlined in specific management plans (Biodiversity Management Plan, Waste and Materials Management, Water Resources Management Plan etc) are referenced within the CoC.</p> <p>All workers will be briefed on the Code of Conduct at the moment of recruitment, explaining ways of monitoring and consequences in case of violation.</p> <p>Measures to include:</p> <ul style="list-style-type: none">Appropriate attire for men and women – for health and safety and cultural reasonsCommunity relations and sensitivitiesHygiene/ Health	Implementation: Contractor Approval: PIURR CEP	PIURR, CEP Information – included in reports to the Lenders	<p>Completion of CoC</p>

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			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">Rules related to alcohol and drug use;Equal opportunities and gender-sensitive conductBanned activities – no hunting/ poaching, no picking of berries / fruit / seeds or medicinal herbsNon discrimination <p>Special attention will be given to the prevention of gender-based violence and the promotion of a gender-sensitive working environment on construction sites, in line with the Local Employment Plan (LEP) and attached Gender Action Plan (GAP). A specific training session will be delivered on the Code of Conduct provisions on sexual harassment, abuse and exploitation at the moment of induction.</p>			
18	Land Acquisition and Resettlement Plan	<p>Prior to construction, develop a Land Acquisition and Resettlement Plan (LARP) that includes the alignment, the access roads to the new alignment and the planned construction access roads before any related land take and restrictions to accessing livelihoods take place.</p> <p>Organise consultation meetings with resettlement affected people to let them know about the processes, timing, impacts and procedures of land acquisition in advance.</p> <p>Complete all land acquisition and livelihood restoration activities according to the LARP.</p> <p>Arrange for the independent completion audit of land acquisition and economic displacement activities in line with LARP, national legislation and Lenders’ requirements.</p>	PIURR, PIURR Consultant	PIURR, Technical Advisor for ADB, OFID, EBRD,AIIB and PIURR Survey reports LARP Consultation Meetings	Satisfactory completion of the LARP. LRP to be approved by Lenders PR5
19	Social, Community and Health Review	As part of the project preparation, Social Community and Health Review needs to be completed for the project. This will include a review of matters including existing medical facilities, disease and health risks to the local community. This will include both existing risks and risks related to the Project - in-migration of construction workers can subsequently lead to increased health risk to the local community (i.e. the potential for	PIURR Contractor to develop Health Plan based on findings of Social	Review of health risks and updated in response to changes on site including road	Social Community and Health Review. Social Risk Register in the ESMS.

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Pre-construction and Construction					
		<p>transfer of communicable or infectious diseases, such as hepatitis, polio, influenza, HIV/AIDS, malaria, etc), crime levels, instances of alcoholism and drug use amongst others. This includes increased impacts to women and vulnerable groups, including the possibility of gender based violence.</p> <p>The findings of the review will inform the development of plans to safeguard the health and wellbeing of the local community during construction.</p> <p>A Health Plan will be developed based on findings of Social Community and Health Review and incorporated intothe Health and Safety Plan</p>	<p>Community and Health Review.</p> <p>Approval – Supervising Engineer</p>	<p>safety, influx management.</p> <p>PIURR</p>	<p>Social and Health plan established.</p>
20	<p>Labour and Working Conditions Management Plan (LWCMP)</p> <p>Including –</p> <ul style="list-style-type: none">Local Employment and Procurement Plan (LEPP)Social Risk RegisterGender Action Plan	<p>The Labour and Working Conditions Management Plan (LWCMP) will include:</p> <ul style="list-style-type: none">policy/legal framework information (including labour and OHS requirements of national legislation and EBRD Performance Requirements),contractor’s human resource policy statement;workforce induction and training;information on labour rights, and establishment of a worker’s organisation in the project area to allow for the potential for collective bargaining;prevention of child and forced labour;equal opportunities and non-discrimination, and how this will be applied for all workforce;management of impacts associated with migrant workers,Measures to counter the potential risk of Gender Based Violence (GBV) (with reference to the Code of Conduct);Rules related to alcohol and drug use;worker accommodation requirements,non-employee worker gaps	<p>Supervising Engineer/ PIURR,</p> <p>Information – included in reports to the Lenders.</p> <p>Contractor Code of Conduct</p> <p>Labour audit.</p> <p>Complaints log.</p>	<p>Safety induction completed.</p> <p>24-hour hotline operational.</p> <p>Regular training provided.</p> <p>No findings in the labour audit.</p> <p>GRM Established.</p>	<p>Tajik Labour Laws</p> <p>International Labour Organisation (ILO) requirements</p> <p>PR1, PR2, PR4</p>

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Pre-construction and Construction					
		<ul style="list-style-type: none">workforce grievance mechanism,sourcing and management of security personnel (with reference to the Voluntary Principles on Security and Human Rights¹²⁰), andother matters as required <p>Conduct induction training for all workers prior to the start of civil works, in a language(s) and format easily understood by the workforce (see Section 17 Code of Conduct). The workforce Induction and documentation should specifically include: worker rights and responsibilities, including the worker grievance procedure, cultural context induction, and interaction/engagement with community members. The induction needs to apply for all workers (anyone working on the project site).</p> <p>The contractor needs to ensure that the core labour requirements are cascaded down across the entire contracting chains, including sub-contractors and suppliers of core materials.</p> <p>The LWCMP will tie in with the Grievance Redress Mechanism (GRM).</p> <p>The LEPP will describe the measures to be taken to promote local procurement and employment. Key actions will include processes and commitments to:</p> <ul style="list-style-type: none">Maximise number of local people employed in pre-construction and construction works (both men and women).Maximise goods and services sourced from local commercial enterprises.The need for work conditions to be competitive but comparable to equivalent employers, including equal pay for equal work by migrant workers (e.g. construction force labourers that may be engaged);			

¹²⁰ <https://www.voluntaryprinciples.org/>

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Pre-construction and Construction					
		<p>The engineer / PIURR will undertake a labour audit during the first month of the construction phase to confirm compliance with the Labour Standards identified above.</p> <p>The contractor will supply and/or employ workers with appropriate skills / competencies and qualifications.</p> <p>The Gender Action Plan (GAP) will complement the LEPP and describe affirmative measures to be taken to promote women in construction and gender-sensitive construction practices. Key actions will include processes and commitments to:</p> <ul style="list-style-type: none">• The prevention of any form of gender-based violence, including sexual harassment (in line with the Code of Conduct), including through the provision of explanatory sessions on the anti-harassment policy to all new and existing workers,• The development of concrete, affirmative measures, in collaboration with PIURR and the Lenders, to increase the number of women in specific positions through active local recruitment campaigns and outreach to VET institutions and Faculties of Engineering,• The provision of adequate working conditions and Personal Protective Equipment (PPE) to workers of both sexes - customised by anthropometric specifications of women and men workers.• The need for work conditions to provide a safe, secure and equal environment for men and women, including separate toilets for male and female workers with access to water and soap close to the actual places where women work, installation of lighting inside toilets and in the area through which women access these facilities, provision of adequate premises where women can get ready before starting work (i.e. accessible and clean places equipped with changing room and a toilet, in a facility that is well-illuminated, adequate lighting on site at night;			

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Pre-construction and Construction					
		<ul style="list-style-type: none">• The promotion of gender-responsive external communications, including through presentation of men and women road workers in visual PR and communications materials (from recruitment to delivery of the Project), consistent usage of images to represent the entire client base services (e.g. women and men of local communities benefiting from road construction and maintenance); use of non-sexist, gender-sensitive language, the respectful non-sexualised depiction of women, and provision of female role models based on women’s competence and professional skills in all public presentations, print and media, for local employment recruitment and other campaigns;• The maintenance of relationships with relevant community groups (especially women’s groups);• The establishment of a system for monitoring the Gender Action Plan.			
21	Traffic Management Plan (TMP)	<p>The plan shall be designed to ensure that traffic congestion and traffic safety impacts due to construction activities and movement of construction vehicles, haulage trucks, and equipment is minimised. The plan shall be prepared in consultation with traffic officials. The plan will cover both on-site and off-site traffic movements.</p> <p>The plan shall identify traffic diversion and management issues, traffic schedules, traffic arrangements showing all detours/lane diversions, modifications to signalling at intersections, necessary barricades, warning/advisory signs, road signs, lighting, and other provisions to ensure that adequate and safe access is provided to motorists and other road users in the affected areas.</p> <p>Pre-construction access road surveys will also form part of the TMP.</p> <p>The Contractor shall provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions at least 24 hours</p>	Preparation: Contractor Approval: Engineer, PIURR	PIURR/ Supervising Engineer. Information – included in reports to the Lenders.	Plan approved as part of the SEMP by relevant parties. PR1, PR2, PR3, PR4

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			Implementation	Monitoring	
Pre-construction and Construction					
		<p>before the disruptions. Construction site access roads which are also used by local traffic shall include safe passing places every 200 m where the roads are narrow.</p> <p>Access roads for batching plants, etc, should be maintained to their existing (or better) condition during the construction phase.</p> <p>Construction site access roads and village access roads should be inspected regularly to identify any damage to verges, bridges, culverts, etc and any deterioration will be repaired as soon as practicable.</p> <p>Regularly monitor traffic conditions along construction site access roads and village access roads to ensure that project vehicles are not causing congestion or traffic hazards.</p> <p>Install temporary accesses to properties affected by disruption to their permanent accesses and ensure access is possible at all times.</p> <p>Reinstate good quality permanent accesses following completion of construction.</p> <p>Impose speed limits on construction vehicles when travelling along residential areas.</p> <p>As part of the Traffic Management Plan, the Contractor shall consult with local residents to establish processes and locations for safe livestock crossing of the proposed access roads.</p>			
22	Health and Safety Plan To include <ul style="list-style-type: none">specific measures for the	<p>This will be developed in a format and with content consistent with international standards (e.g., World Bank Group Environmental, Health, and Safety Guidelines, 2007).</p> <p>The Plan shall address health and safety hazards associated with construction activities (e.g., excavations, tunnelling etc.), use of heavy equipment, transport of materials and other hazards associated with various construction activities, including both risk to site</p>	<p>Preparation: Contractor</p> <p>Approval: Engineer, PIURR</p>	<p>PIURR/ Supervising Engineer.</p> <p>Information – included in reports to the Lenders</p>	<p>Plan approved as part of the SEMP by relevant parties.</p> <p>PR2, PR4</p>

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
	construction of bridges and tunnels <ul style="list-style-type: none">Health Plan	<p>personnel and to the community. The Plan shall address hazards from a gender perspective, for the Plan to be in line with the Gender Action Plan</p> <p>The document to be read together with the Camp Management Plan, and other activity-specific sub-plans.</p> <p>All workers (including sub-contractors) will receive a formal induction ahead of starting works, in a language(s) and format easily understood by the workforce. This will include information on health and safety measures, emergency response in case of accidents, fire, earthquakes, landslides, flash foods, disease etc, and minimisation of environmental and community impacts. The Contractor will also develop and implement a safety and security training program including toolbox talks, safety briefings, and issue specific training. Conduct safety meetings on monthly regular basis.. The Contractor shall develop women-only training sessions and safety meetings and discuss any additional health and safety concerns from a gender perspective.</p> <p>General Safety Measures</p> <ul style="list-style-type: none">Appointment of an environment, health and safety, (EHS) manager to supervise implementation of mitigation measures, to ensure that environment, health and safety precautions are strictly implemented, evaluate efficiency of mitigation measures and identified new measures if required.Develop and implement a process for reporting and investigating incidents, injuries, near misses and unsafe conditions <p>Community road safety measures to include:</p> <ul style="list-style-type: none">Provide driver training programmes to ensure that Contractor’s staff are aware of community sensitivities, such as specific livestock movement periods.			

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">• Ensure lighting in public places is adequate and is maintained, particularly to reduce gender-based violence and construction and road safety risks at night,• Provide safe road crossings for children including adequate signals to alert presence of children and families.• Provide a series of road safety awareness sessions for schools in the Project Area. The sessions will be provided on a six-monthly basis throughout the construction phase.• As part of the awareness sessions, children will be given reflective badges to fix to their coats and school bags.• Ensure all construction driving is to occur during daytime hours, where possible.• Prepare guidelines for maximum driving hours per day and week, to prevent driver fatigue.• All drivers to adhere to site and national speed limits, reinforced by speed limit signage and sanctions for non-compliance.• Provide road signs in accordance with the approved traffic management plan.• Consult with local households, community groups, police, and emergency services along the transport routes as per the SEP.• Consult with local households and community groups to establish locations and methods for allowing safe passage of animals / stock across the route. Crossing points are recommended.• Develop and implement a program of workplace inspections and audits, to monitor the effectiveness of EHS control measures. <p>Health and Welfare</p> <ul style="list-style-type: none">• Provide adequate housing conditions and services for all workers at the construction camp/camps as per requirements of national legislation, and			

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<p>EBRD/ADB/AIIB standards, including EBRD/IFC Guidance Note: Workers’ Accommodation: Processes and Standards¹²¹.</p> <ul style="list-style-type: none">• Provide separate hygienic sanitation facilities/toilets and showers areas with sufficient water supply for male and female workers.• Provide reliable and sufficient supply of safe potable water at all times. Ensure that all supplies meet the drinking water standards of Tajikistan.• Establish clean canteen/rest areas with hand washing facilities.• Provide portable toilet facilities with hand washing facilities for workers at work sites. Toilet facilities must not pollute surface waters and must have holding tanks with waste transferred back to camp• The construction camp will be staffed and equipped with a health clinic for all workers. <p>Security</p> <ul style="list-style-type: none">• Provide appropriate security measures to prevent unauthorised access to hazardous work sites, including fencing on all areas of excavation greater than 1 m deep.• Enforce access restrictions by means of regular monitoring of site boundaries (either by patrols or by camera) <p>PPE</p> <ul style="list-style-type: none">• Provide appropriate personnel protection equipment (PPE) and harnesses (safety boots, helmets, gloves, protective clothes, breathing mask, goggles, and ear protection) adequate to task/activity. The PPE is to be provided for all site personnel – contractors, subcontractors, Project Management and Construction			

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Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<p>Supervision Consultant staff, and site visitors (including drivers who leave their vehicle cabs while on site). Sufficient stocks of PPE must be held at all camps.</p> <p>Excavations</p> <ul style="list-style-type: none">• Minimise the duration of excavations, and backfill as soon as practicable,• Install warning signs where required, in accordance with other management plans (e.g. Traffic Management Plan).• Implment measures to avoid damage to buried utilities (e.g. consultation with service providers and land users, use of service location equipment, support for exposed services, etc.) <p>Plant and Equipment</p> <ul style="list-style-type: none">• Regularly inspect, test and maintain all safety equipment. Immediately replace equipment that is not in working order, damaged and/or not fit to use.• Ensure reversing signals are installed on all construction vehicles, although consider the noise impacts and controls in the Noise and Vibration Management Plan. <p>Work at Height / Fall Prevention</p> <ul style="list-style-type: none">• Implement fall prevention and protection measures whenever a worker is exposed to the hazard of falling more than two meters, falling into operating machinery, falling through an opening in a work surface, or other dangerous location. Fall prevention/protection measures may include• installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area;• installation and inspection of scaffolds by competent persons• regular inspection of ladders and access equipment• proper use of ladders and scaffolds by trained employees,			

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">• use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard, fall protection devices such as full body harnesses, etc. Regular inspection of fall prevention devices.• Mark the areas where risk of injuries from falling objects exist with rope or flagging to minimise risks and injuries. <p>Work in Confined Spaces</p> <ul style="list-style-type: none">• Develop a procedure for entry into confined spaces, including training of personnel, PPE requirements, rescue provisions, etc.• Prohibit entry into confined spaces, except by trained persons using the controls developed. <p>Electrical Equipment and Electrical Works</p> <ul style="list-style-type: none">• Ensure that all electrical equipment is suitable for use in a harsh construction environment.• Regularly inspect electrical equipment and replace / repair if damage is identified.• Ensure that electrical works are only conducted by qualified and experienced personnel• Ensure that power supply is disconnected and isolated before work is allowed on electrical systems. <p>Lifting Operations</p> <ul style="list-style-type: none">• Ensure that all lifting operations are planned and supervised by suitably qualified and experience persons, to minimise risk to persons on site, and to co-ordinate with other site activities. This must include measures to avoid contact of lifting equipment and loads with above ground utilities and structures.• Prevent persons from walking beneath loads.			

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">• Ensure all loads are properly secured• A programme of inspection and testing to be developed and implemented for all lifting equipment, including all straps, chains, shackles, etc. <p>Hazardous Chemicals</p> <ul style="list-style-type: none">• Ensure that all hazardous chemicals are stored appropriately in suitable containers and labelled with the name and hazards of the contents.• To prevent bitumen burns ensure workers handling hot bitumen to wear full-body protection.• All transportation, handling and storage of bitumen will be done by experienced personnel.• Ensure all hazardous materials are stored (including within suitable sized bunds for liquids), handled and disposed of appropriately.• Keep a plan of site indicating where all hazardous materials are stored. <p>Heat / Cold Exposure</p> <ul style="list-style-type: none">• Provide suitable clothing for work during cold and/or wet, weather.• Provide shaded rest areas and drinking water, and organise work to allow for sufficient rest breaks during hot weather. <p>Site Illumination</p> <ul style="list-style-type: none">• Provide sufficient lighting at night within and in the vicinity of construction sites, but consider need for mitigation of impact on wildlife and community.			
23	Emergency Response Plan Including –	Develop and implement emergency preparedness and response plans (ERP) for each Project package. These should include measures for prevention, mitigation and response to emergency scenarios, at a minimum covering:	Preparation: Contractor	PIURR/ Supervising Engineer.	Plan approved as part of the SEMP by relevant parties.

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
	<ul style="list-style-type: none">Natural Disaster ResponseSpill Management Plan	<ul style="list-style-type: none">Road and traffic accidents;Other accidents and injuries;spills of hazardous substances;fire;natural disasters (earthquake, landslip, flood, extreme weather events, etc.);accidents during tunnelling (e.g., tunnel collapse, tunnel fires, gas release, etc.).The ERP should describe<ul style="list-style-type: none">Roles and responsibilities for prevention and responseProcedures for responding to different scenarios (fire, flood, traffic accident, etc.)Resources required (personnel and equipment) and how these will be provided and maintained. This must consider delays to emergency response services, due to the current condition of the roadCompetence and training requirements <p>The Spill Management Plan will include procedures, responsibilities, resources, documentation and reporting requirements, training provisions for relevant staff, etc. to avoid spills of hazardous substances and to effectively respond to such incidents.</p> <ul style="list-style-type: none">All refuelling activities must occur on hard surfacing.Provide first aid facilities that are readily accessible by emergency response personnel and workers.Provide firefighting equipment at the work areas, as appropriate, and at construction camps. <p>The ERP must be regularly reviewed and updated – as a minimum annually and after any emergencies or accidents.</p>	Approval: Engineer and PIURR,	Information – included in reports to the Lenders.	PR2, PR3, PR4
Activity Specific Sub-Plans					

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
24	Camp Management Plan	<p>Prior to start of site works, an Environmental and Social Screening of potential camp locations prior to construction, to identify any sensitive environmental receptors and to ensure the camps are of sufficient distance from villages and local communities. Consultation with local communities before the construction camp is developed is required, covering</p> <ul style="list-style-type: none">• Location of camps over one kilometre from any residential area and at least 50 m from any surface watercourse and not within 2 km of a protected area – any deviation from these separation distance must be supported by sufficient justification and additional mitigation measures, and the location and mitigations must be approved;• Coordination of all construction camp activities with neighbouring land uses;• confirmation as to whether workers can be accompanied by families or whether rosters will enable locally engaged workers to go home daily or not. <p>Prior to start of site works, the Contractor shall develop a Camp Management Plan. This will include:</p> <ul style="list-style-type: none">• Ensuring that workers’ accommodation/ construction camps is designed and managed in compliance with EBRD/IFC guidance on workers’ accommodation:122; and• layout of the site, including location of temporary specifications for storage areas for waste, equipment maintenance areas, lubricant and fuel storage sites with indication of the distance from watercourses and other sensitive receptors	<p>Preparation: Contractor</p> <p>Approval: Engineer, PIURR</p>	<p>PIURR/ Supervising Engineer.</p> <p>Information – included in reports to the Lenders</p>	<p>Plan approved as part of the SEMP by relevant parties.</p> <p>PR1, PR2, PR3, PR4, PR5, PR6, PR10</p>

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Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">• description of sewage management activities, including treatment, monitoring and effluent disposal processes;• description of waste management activities, including waste minimisation, and storage and disposal processes for each waste stream;• community relations, restriction of access to camp and facilities, induction briefing on camp rules and local issues/sensitivities, camp rules (such as restrictions on; alcohol, drugs use, discipline, noisy activities, community liaison, no poaching, environmental protection measures applicable to the camp site, decommissioning and re-cultivation, etc.), and workers welfare <p>The construction camps will be staffed and equipped with a health clinic for all workers.</p> <p>The Contractor will be responsible for maintenance and clean-up of campsites and respecting the rights of local land users.</p> <p>The Camp Management Plan will indicate the system proposed and the locations of related facilities in the site, including latrines, showers, canteen, recreation facilities, laboratories, maintenance areas, etc. The plan will cover camp sites as well as any sites considered as associated facilities, and will require IFI consideration, due diligence and approval.</p> <p>The plan will cover camp sites as well as any sites considered as associated facilities, and will require ADB, OFID, EBRD and AIIB consideration, due diligence and approval.</p> <p>The plan will cross reference other sub-plans including; Water Resources Management Plan, Spill Management Plan, Air Quality Management Plan, Noise and Vibration Management Plan, Waste and Materials Management Plan, and others as required.</p>			

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
25	Concrete and Asphalt Production Management Plans	<p>Prior to start of site works, the Contractor shall develop a Concrete and Asphalt Production Management Plan. This will include:</p> <ul style="list-style-type: none">• Describing the layout and management of asphalt and concrete batching plant including:• Location, hours of use, water discharge, noise and vibration management and dust control.• Batching plants will be located downwind of residential areas and not within 1 km of any residential area.• The entire batching area traversed by vehicles – including driveways leading into and out of the area – will be paved with a hard, impervious material.• Sand and aggregates will be delivered in a dampened state, using covered trucks. If the materials dry out during transit they will be covered to avoid creation of dust.• Sand and aggregates will be stored in a hopper or bunker which shields the materials from winds. The bunker should enclose the stockpile on three sides. The walls should extend 1 m above the height of the maximum quantity of raw material kept on site, and extend 2 m beyond the front of the stockpile.• The hopper or bunker will be fitted with water sprays which keep the stored material damp at all times.• Monitor the water content of the stockpile to ensure it is maintained in a damp condition.• Overhead storage bins will be totally enclosed. The swivel chute area and transfer point from the conveyor will also be enclosed.• Rubber curtain seals may be needed to protect the opening of the overhead bin from winds.	<p>Preparation: Contractor</p> <p>Approval: Engineer, PIURR</p>	<p>PIURR/ Supervising Engineer</p> <p>Information – included in reports to the Lenders.</p>	<p>Plan approved as part of the SEMP by relevant parties.</p> <p>PR1, PR2, PR3, PR4</p>

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">• Conveyor belts which are exposed to the wind and used for raw material transfer will be effectively enclosed, to ensure dust is not blown off the conveyor during transit. Conveyor transfer points and hopper discharge areas will be fully enclosed.• Conveyor belts will be fitted with belt cleaners on the return side of the belt.• Weigh hoppers at front end loader plants will be roofed and have weigh hoppers shrouded on three sides, to protect the contents from the wind.• The raw materials transferred by the front-end loader should be damp, as they are taken from a dampened stockpile.• Store cement in sealed, dust-tight storage silos. All hatches, inspection points and duct work will be dust-tight.• Silos will be equipped with a high-level sensor alarm and an automatic delivery shut-down switch to prevent overfilling.• Cement dust from the silo during filling operations must be minimised. A fabric filter dust collector will be used.• The cement weigh hopper will be enclosed, to ensure that dust cannot escape.• An inspection of all dust control components will be performed regularly – for example, at least weekly. <p>The plan will cross reference other sub-plans including; Water Resources Management Plan, Spill Management Plan, Air Quality Management Plan, Noise and Vibration Management Plan, Waste and Materials Management Plan, and others as required.</p>			
26	Construction plans and Method Statements Including –	<p>Plans will outline the specific construction for each element of the Project.</p> <p>The Bridge Construction Plan will outline measures including:</p> <ul style="list-style-type: none">• general construction noise at the portals during “mucking out” (removal of rock spoil) and vehicle movements (removing spoil),	Preparation: Contractor	PIURR/ Supervising Engineer	<p>Plans approved 14 days prior to commencement of works in these areas.</p> <p>PR1, PR2, PR3, PR4</p>

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
	<ul style="list-style-type: none">• Bridge Construction Plan• Tunnel Construction Plan• Tunnel Handover Plan• Slope Stabilisation Plan	<ul style="list-style-type: none">• noise and vibration during the drill and blast work (though generally confined to the works developing the portal area),• dust generation works (particularly portal emissions from extraction fans);• potential for both silty and oily runoff; and• Disturbance to fauna, particularly nesting birds and roosting bats, etc..from blasting noise and vibration. <p>The Tunnel Construction Plan will outline measures including</p> <ul style="list-style-type: none">• Use of non-toxic slurry and additives and minimise impact of these materials to reduce risk of impact on ground water quality.• Ensure that pressure applied to tunnelling and ground treatment is controlled to prevent excessive pressure that will drive the slurry out of the desired range increasing the risk of water pollution.• Ensure any de-watering does not impact groundwater users (users of wells etc).• Include cross reference to the Blasting Management Plan <p>The Tunnel Handover Plan will as a minimum include an operations handover process and the documentation required for handover; training requirements including commissioning and staffing requirements; occupational health and safety requirements and risk management and reporting.</p> <p>The Slope Stabilisation Plan will determine the specific areas of slope stabilisation works ahead of construction.</p> <p>All Construction Plans will cross reference relevant; environmental, social and health and safety sub-plans.</p>	Approval: Supervising Engineer, PIURR	Information – included in reports to the Lenders	

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
27	Method Statements for Temporary Activities Including – <ul style="list-style-type: none">Storage AreasRiver crossingsRoads/ Access Roads	The Contractor will be responsible for preparing a method statement for any temporary activities and infrastructure (e.g. temporary roads, temporary river crossings, temporary storage areas), including establishment, operation and reinstatement of the facilities.	Preparation: Contractor Approval: Engineer, PIURR	PIURR/ Supervising Engineer Information – included in reports to the Lenders	Statement approved 14 days prior to commencement of works in these areas. PR1, PR2, PR3, PR4
28	Blasting Management Plan Including – <ul style="list-style-type: none">Tunnel specific measures	<ul style="list-style-type: none">The Contactor must appoint an authorised blasting contractor.The Contractor must audit suppliers, ensure all approvals and authorisations are in place and good practices are applied in line with international practice ahead of blasting worksMethodology for the management of control of tunnel blasting including methods for noise and air quality management and occupational and community health and safety.Blasting will be scheduled during the day only.Communities (within the area impacted by blasting related impacts) will be informed of blasting timetable in advance and will be provided adequate notice of when blasts are required outside of the planned schedule.Throughout the blasting activity, if required, vibration sensors will be installed at strategic locations to monitor the impact of blasting and to ensure that the vibration levels are within the adopted criteria. The monitoring plan will be part of the Blasting Management Plan.	Preparation: Contractor Approval: Supervising Engineer, PIURR	PIURR/ Supervising Engineer. Information – included in reports to the Lenders.	Plan approved as part of the SEMP by relevant parties. PR1, PR2, PR3, PR4

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">Use blasting design with consideration of safety, blast geometry, free faces, burden, spacing, initiation pattern (delayed blasting) and angled holes. Use multi deck blasting technique is considered as efficient method creating lower vibration.Develop and implement suitable procedures for management of explosives, including security and storage arrangements.Must be produced in accordance with the requirements of the Biodiversity Management Plan (e.g. regarding avoidance of impacts to nesting birds and roosting bats, etc.). <p>The Blasting Management Plan will set out the safe and secure storage of blasting equipment (including explosives) when not in use.</p>			
29	Construction Road Access Management Plan	<p>A Construction Access Road Management Plan will be developed, which will include measures for the establishment, operation and timely reinstatement of the roads. Disruption to villagers along the construction access roads must be minimised at all times.</p> <p>The construction access roads shall be carefully chosen and delineated to minimise impacts on landscape and soil erosion, and damage to bridges, river banks, verges, drain conduits and other structures along the route, and will be closely monitored to eliminate their unduly expansion during construction works.</p> <p>The top surface of access roads and work areas should be graded and compacted before works commences and maintained through the works to remove ruts and potholes. The access roads should be watered to reduce impact of dust caused by vehicles running on dry dusty surfaces. Speed limits should be identified by the contractor and strictly maintained to reduce noise and dust emissions and for road safety purposes.</p>	<p>Preparation: Contractor</p> <p>Approval: Supervising Engineer, PIURR</p>	<p>PIURR/ Supervising Engineer.</p> <p>Information – included in reports to the Lenders.</p>	<p>Plan approved as part of the SEMP by relevant parties.</p> <p>PR1, PR2, PR3, PR4</p>

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<p>The requirements for environmental, social and safety controls on the access roads will be identified during the assessments of each route, but will implement the same types of management plan as set out in the EMP (for issues such as safety management, dust control, water control, etc.) for the main alignment.</p> <p>Noise and Vibration (See Noise and Vibration Management Plan EMP Ref 9),</p> <ul style="list-style-type: none">• Use well maintained construction equipment and vehicles.• Use construction equipment and vehicles fitted with appropriate noise suppression. Fit all pneumatic tools with an effective silencer on their air exhaust port.• Use temporary noise barriers while working in sensitive locations if allowable noise limits are expected to be exceeded.• Impose speed limits on the project vehicles to minimise noise emission while moving along/across the sensitive areas.• Keep to no horn policy unless vitally necessary.• As much as possible, use quiet equipment and working method: e.g. Diesel hammer piling – substituted with drill piling or hydraulic piling.• Whenever possible: enclose noisy equipment, restrict non- stop operation of noisy equipment, avoid simultaneous operation of noise generating equipment.• Consider seasons sensitive for birds and other wildlife while planning noise-generating works, with cross reference to the biodiversity management plan.• Train staff in best practice for noise reduction and mitigation.• Inform community on schedule and duration of construction activities, particularly where these are likely to generate high noise levels.• Implement 24-hour community complaints hotline.			

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">Limit truck speed - not to exceed 40 km/h, when driving through communities, and not to exceed 80 km/h when driving on highways.Time and Activity Constraints, i.e., operations will be scheduled to coincide with periods when people are least likely to be affected; construction work hours and work days will be limited to less noise-sensitive times. Hours-of-work will be approved by the Engineer having due regard for possible noise disturbance to the local residents or other activities.Construction activities will be strictly prohibited between 10 PM and 6 AM near residential areas. When operating close to sensitive areas (within 250 m) such as residential, nursery, or medical facilities, the Contractor’s hours of working shall be limited to 8 AM to 6 PM.Noise protection kits such as ear plugs, earmuffs, will be provided for workers who are working in areas where noise levels are higher than 80 dB(A), and made available to all workers on request, regardless of noise level. Mandatory use of hearing protection will be required at noise levels over 85 dB(A) <p>Air quality (see air quality managent plan EMP ref 8)</p> <ul style="list-style-type: none">Ensure all machinery and vehicles are maintained to minimise exhaust emissions. Vehicles and equipment that emit smoke will not be used and if they can’t be fixed shall be removed from the project.Undertake immediate repairs of any malfunctioning construction vehicles and equipment.Use construction equipment and vehicles that meet national emission standards.Wherever possible, use electrically-powered equipment rather than gas or diesel-powered equipment.			

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<ul style="list-style-type: none">• Use fuel efficient machinery.• Ensure that all diesel and petrol running machinery use is equipped with catalytic convertors.• Position any stationary emission sources (e.g., portable diesel generators, compressors, etc.) as far as is practical from sensitive receptors.• Locate support facilities and spoil disposal sites to reduce trip numbers and travel distance – as far as feasible.• Provide truck-washing facilities at tunnel portals and at safe distance from bridge construction sites to prevent track-out of mud and dust.• Implement a regular vehicle maintenance and repair program, utilising the manufacturer recommended maintenance programs.• All trucks used for transporting materials to and from the site will be covered with canvas tarpaulins.• Carry out watering for dust control at least 3 times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25°C, or in windy weather. Avoid overwatering as this may make the surrounding muddy.• Ensure compliance with the Water Resources Management Plan, including maintenance of resources used by the local communities are maintained at all times, including rapid provision of alternative temporary supplies in the event of disruption to usual supply.• Earthwork operations to be suspended when the wind speed exceeds 20 km/h (based on on-site monitoring) in areas within 500 m of any community.• Provide vegetation planting along roadsides to stabilise soils and reduce air quality impacts.			

Ref	Environmental or Social Aspect/ Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator / EBRD Performance Requirement
			Implementation	Monitoring	
Pre-construction and Construction					
		<p>Water quality (See Water Resource Managent Plan EMP ref 7)</p> <ul style="list-style-type: none">Any temporary fuel tanks (if contractor requires small stock of fuel on the site) shall be placed in a secured, covered area with berms or dikes to contain any spills. Capacity of containment must be 110% of capacity of the tank. Any spill shall be immediately contained and cleaned up with absorbent material as per the Spill Management Plan.Discharge of any untreated water into the surface water body strictly prohibited. Treated water discharge must comply with International Finance Corporation (IFC) and EU standards for effluent discharge, as well as national standards and any licence / permit requirements.No concrete works envisaged – Follow procedures in EMP for concreting works if it is needed.In disturbed soil areas silt fence, fibre rolls (biodegradable logs), gravel bags, or other approved sediment control must be ensured. At a minimum, bare soil must be protected before it rains.Store materials in suitable containers, with clear legible labels. The same applies to containers for short term storage of used oil.Ensure availability of spill clean-up materials (e.g., spill kits, etc.) in the areas where accidental spills may occur.Prohibit discharge of any untreated potentially contaminated effluents			

8.7 Operational Phase EMP

835. An Environmental and Social and Management Plan has been developed for the operational phase of the Project. This identifies the need for a number of sub-plans to manage specific issues or activities (Table 77)

Table 77: Environmental Management Plan – Operational Phase

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
Operation					
Overall Operational Environmental & Social Management Plan (OESMP)					
10	Development of an Operational Social & Environmental Management Plan (OESMP)	<p>The PIURR shall prepare an over-arching operational phase Environmental Management Plan (OESMP). The OESMP will</p> <ul style="list-style-type: none">Set out processes and responsibilities for implementation of the requirements of permits, licences, lenders and regulations associated with operation and maintenance of the Project after constructioninclude all of the sub-plans listed below<ul style="list-style-type: none">Operational Stakeholder Engagement Plan (SEP)Operational Community Health and Safety Management PlanOperational Worker Health and Safety Management PlanRoad Safety AuditsTunnel Operational Management PlanMaintenance Depot InspectionsEmergency Response Plans, including Tunnel Emergency Response PlanOperational Drainage Management PlanOperational Biodiversity Management PlanOperational Waste Management PlanAir Quality Management Plan, including air pollution from transport emissions and air quality and greenhouse gas emissions as a result of maintenance activities.Operational Noise Management PlanOperational Soil Management PlanClimate Resilience Management Plan	PIURR	PIURR Information – included in reports to the Lenders.	OESMP and plans developed and implemented PR 1, PR2, PR3, PR4, PR6, PR8

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
Operation					
		The PIURR will implement a OESMS in line with national and international EHSS Standards. This OESMP should be costed so that an annual budget can be established			
Community, Labour and Safety Management Plans					
20	Operational Stakeholder Engagement Plan (SEP)	<ul style="list-style-type: none">• Update the Project SEP for the operational phase.• Implement the SEP and organise regular consultation activities with local communities.• A Community Liaison Officer (CLO) shall be appointed to manage consultations and implement the developed SEP with local communities.• Organise consultation events for men, women and children (including vulnerable groups) as and when required.• Focus groups are preferred methods for engagement with vulnerable groups. Separate males and females focus group discussions should be conducted.• Women must be consulted on road safety, and given fair and equal representation of women in decision-making situations and greater awareness of road safety from a gender perspective.• Data to be collected on road safety from a gender perspective in the region and results communicated.• Develop outreach and campaign promoting gender-responsive road safety. This includes understanding masculinities and men’s behaviours in relation to road safety so as to better target potential campaigns.• The road should promote public transport and space that is pedestrian-friendly, female friendly, disabled friendly and child friendly.• Safe road crossings for children including adequate signals to alert presence of children and families.	PIURR	PIURR Information – included in reports to the Lenders	Consultation completed with the identified stakeholders per the SEP and results of consultations presented to PIURR and Lenders.

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
Operation					
		<ul style="list-style-type: none">Adequate lighting in public spaces around the road should be provided to reduce gender-based violence and road safety risks at night.Update SEP on annual basis			
30	Operational Community Health and Safety Management Plan	<ul style="list-style-type: none">Co-ordinate with police by the PIURR to ensure regular patrolling as per other international roads.Install warning signs, as per the recommendations of the Road Safety Audit.Consult with local households, community groups, police, and emergency services as per the SEP. Investigate all community concerns related to road safety during road operation.Inform community about any hazards and/or restrictions.Provide road signs in accordance with national regulations and the recommendations of the Road Safety AuditEnsure lighting in public places is adequate and is maintained, particularly to reduce gender-based violence and road safety risks at night,Provide safe road crossings for children including adequate signals to alert presence of children and families.Maintain an accident log and review regularly to identify potential to reduce future accidents.	PIURR	PIURR Information – included in reports to the Lenders.	Road included in police patrols. Inclusion of rest areas.
310	Operational Worker Health and Safety Management Plan	<p>This will be developed in a format and with content consistent with international standards (e.g., World Bank Group Environmental, Health, and Safety Guidelines, 2007).</p> <p>The Plan shall address health and safety hazards to workers associated with maintenance of roads, bridges, tunnels, etc.</p> <p>All workers (including sub-contractors) will receive a formal induction ahead of starting works, in a language(s) and format easily understood by the workforce. This</p>	PIURR	PIURR Information – included in reports to the Lenders.	

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
Operation					
		<p>will include information on health and safety measures, emergency response in case of accidents, fire, earthquakes, landslides, flash foods, disease etc, and minimisation of environmental and community impacts.</p> <p>The plan will include controls for:</p> <p>Traffic Management</p> <ul style="list-style-type: none">Develop and implement traffic control systems for each maintenance job, including<ul style="list-style-type: none">Signage to warn of lane closures, obstructions and workers in the roadProvision of adequate lighting where needed.Provision of high visibility clothing for workers.Lane and traffic control, e.g. by traffic lights or STOP/GO boardsNotification of potentially affected persons / communities prior to the works using the SEP <p>Health and Welfare</p> <ul style="list-style-type: none">Provide reliable and sufficient supply of safe potable water at all times.Provide portable toilet facilities with hand washing facilities for. <p>PPE</p> <ul style="list-style-type: none">Provide appropriate personnel protection equipment (PPE) (safety boots, helmets, gloves, protective clothes, etc.) appropriate to the task/activity. <p>Excavations</p> <ul style="list-style-type: none">Minimise the duration of excavations, and backfill as soon as practicable,Install warning signs where required. <p>Plant and Equipment</p> <ul style="list-style-type: none">Ensure the correct selection of all work equipment using on the project and that			

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
Operation					
		<p>adequate information, instruction, training and supervision is given to all workers,</p> <ul style="list-style-type: none">Regularly inspect, test and maintain all safety equipment. Immediately replace equipment that is not in working order, damaged and/or not fit to use. Mark all equipment to confirm it has been visually inspected and easily identifiable.Ensure reversing signals are installed on all heavy maintenance vehicles. <p>Work at Height / Fall Prevention</p> <ul style="list-style-type: none">consider the application of a fall prevent hierarchy of control – avoid, prevent, minimiseImplement fall prevention and protection measures whenever a worker is exposed to the hazard of falling more than two meters, or other dangerous location. Fall prevention/protection measures may include<ul style="list-style-type: none">installation and inspection of scaffolds by competent personsregular inspection of access equipmentproper use of ladders and scaffolds by trained employees,use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard, fall protection devices such as full body harnesses, etc. Regular inspection of fall prevention devices. <p>Work in Confined Spaces</p> <ul style="list-style-type: none">Develop a procedure for entry into confined spaces, including training of personnel, PPE requirements, rescue provisions, etc.Prohibit entry into confined spaces, except by trained persons using the controls developed. <p>Electrical Equipment and Electrical Works</p>			

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
Operation					
		<ul style="list-style-type: none">• Ensure that all electrical equipment is suitable for use in a harsh construction environment.• Regularly inspect electrical equipment and replace / repair if damage is identified.• Ensure that electrical works are only conducted by qualified and experienced personnel <p>Lifting Operations</p> <ul style="list-style-type: none">• Ensure that all lifting operations are planned and supervised by suitably qualified and experience persons, to minimise risk to persons on site, and to co-ordinate with other site activities.• Prevent persons from walking beneath loads.• Ensure all loads are properly secured• A programme of inspection and testing to be developed and implemented for all lifting equipment, including all straps, chains, shackles, etc. <p>Hazardous Chemicals</p> <ul style="list-style-type: none">• Ensure that all hazardous chemicals are stored appropriately in suitable containers and labelled with the name and hazards of the contents. <p>Heat / Cold Exposure</p> <ul style="list-style-type: none">• Provide suitable clothing for work during cold and/or wet, weather.• Provide shaded rest areas and drinking water, and organise work to allow for sufficient rest breaks during hot weather. <p>Site Illumination</p> <ul style="list-style-type: none">• Provide sufficient lighting at night within and in the vicinity of construction sites, but consider need for mitigation of impact on wildlife and community.			

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
Operation					
320	Road Safety Audits	Develop and implement a program of road safety audits to assess safety performance along the alignment and village access roads, and to identify any unsafe conditions. This should include a Road Safety Audit at Pre-Opening / Post Construction to confirm recommendations accepted during the design stage Road Safety Audit have been implemented. A further Road Safety Audit should be undertaken 12 months post opening and then periodically every 3 years to assess road traffic collisions along the road and identify any trends / blackspots that required remedial actions. Road safety audits shall factor gender perspectives and identify potential gender adverse impacts and risks.	PIURR Specialist consultant	PIURR, CEP Information – included in reports to the Lenders.	No accidents.
330	Operational Maintenance Plan	Develop and implement a robust maintenance regime for roads, barriers, bridges, drainage and safety features. Inspections must be conducted and managed by suitably qualified and experienced engineers and in line with appropriate Tajik and international standards. A specific programme of inspection and maintenance will also be developed for the tunnels. Sufficient resource must be provided for this programme. The maintenance plans will include inspections related to significant weather events as required by the Operational Climate Resilience Management Plan. All maintenance operations will be conducted in accordance with the Operational Worker Health and Safety Management Plan	Maintenance department of MoT	PIURR, CEP Information – included in reports to the Lenders.	No accidents.
340	Tunnel Operational Management Plan	<ul style="list-style-type: none">• Maintain ventilation in working condition.• Provide firefighting equipment and other facilities in working order.• Ensure tunnel staff are adequately trained in case of emergencies, including rescue, recovery and prevention of access to additional vehicles.	Maintenance department of MoT	PIURR, CEP	No accidents.

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
Operation					
		<ul style="list-style-type: none">Ensure the tunnel is cleaned regularly.Ensure that exit doors to the gallery and the passages are not blocked.		Information – included in reports to the Lenders.	
350	Maintenance Depot Inspections	<ul style="list-style-type: none">Prior to operation, the construction camps that will be converted into Maintenance Depots. These will be inspected prior to conversion to ensure that they are fit for purpose, and any deficiencies corrected.Key areas will include; sanitation, electricity, heating, waste facilities, security, etc.	PIURR, PIURR Consultant	PIURR Information – included in reports to the Lenders	Consultation completed with the identified stakeholders per the SEP and results of consultations presented to PIURR and Lenders.
360	Emergency Response Plans Including Tunnel Emergency Response Plan	<p>Develop and implement emergency preparedness and response plans (ERP) for the operational phase, including a specific plan for tunnel emergencies. These should include measures for prevention, mitigation and response to emergency scenarios, at a minimum covering:</p> <ul style="list-style-type: none">Road and traffic accidents;Other accidents and injuries;Spills of hazardous substances;Fire;Natural disasters (earthquake, landslip, flood, extreme weather events, etc.);Accidents during tunnelling (e.g., tunnel collapse, tunnel fires, gas release, etc.). <p>The ERP should describe</p> <ul style="list-style-type: none">Roles and responsibilities for prevention and responseProcedures for responding to different scenarios (fire, flood, traffic accident, etc.)	PIURR, PIURR Consultant	PIURR Information – included in reports to the Lenders	Consultation completed with the identified stakeholders per the SEP and results of consultations presented to PIURR and Lenders.

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
Operation					
		<ul style="list-style-type: none">Resources required (personnel and equipment) and how these will be provided and maintained. This must consider delays to emergency response services, due to the remote location;Competence and training requirements. Including response drills and exercises. <p>The ERP must be regularly reviewed and updated – as a minimum annually and after any emergencies or accidents.</p>			
Environmental Management Plans					
370	Operational Drainage Management Plan	<ul style="list-style-type: none">Ensure clean up and waste removal from carriageway and roadsides.Store hazardous and potentially contaminating materials (chemicals, fuels, oils, etc.) in areas with watertight flooring, roofing, security fencing and access control and drainage/wastewater collection systems.Maintain integrity and permeability of storm water drainage system to avoid blockage, overflow and direct discharge of untreated runoff into the rivers.Monitor water quality (including: pH; Suspended Solids; BOD5; COD; Coliforms; Nitrate (NO3); Phosphate (PO4); Oil and Grease) in recipient watercourses quarterly (50 m upstream and 250 m downstream the point of discharge). The distance may change depending on accessibility of the river for sampling.Set, implement and adjust clean-up/maintenance schedule to ensure effective operation of the treatment facilities.Check quality of the sediments (list of parameters to control include: heavy metals, petroleum products) prior to making decision on the method of disposal. If contamination detected – use licenced contractor to deal with the waste.Maintain contracts with hazardous waste removal companies to ensure timely and safe removal of skimmed oil, other hazardous waste generated at maintenance facilities.	Maintenance department of MoT Bridge operation staff Tunnel Operation Staff	PIURR, CEP Information – included in reports to the Lenders.	No reduction in water quality.

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
Operation					
		<ul style="list-style-type: none">• Ensure tunnel operation staff are aware of material and waste management requirements.• Ensure maintenance and timely clean-up/removal of sediments accumulated in runoff treatment facilities and drainage systems.• Perform maintenance paving in dry weather to prevent runoff contamination.• During maintenance works, apply the same measures as per construction stage.			
380	Operational Biodiversity Management Plan	<p>The Operational Biodiversity Management Plan will:</p> <ul style="list-style-type: none">• Register and analyse road kills. Develop additional mitigation measures if found to be necessary. e.g. install reflectors /local fencing, warning signs, speed reduction etc.). Liaise with state forest authorities to inform supplementary feeding for carnivores should road kill incidents occur.• Ensure carriageway and adjacent strip are waste free.• Prohibit poaching/plant and seed collection (ensure that tunnel operator staff are also aware of the ban).• Programme of education/awareness-raising of workforce to prevent hunting/poaching/collecting of rare seeds, etc• Monitor the status of re-cultivated areas. (Note: monitoring of vegetation within the guarantee period (as defined by the contract) will form part of the Construction Phase Landscape Management Plan, to ensure successful establishment of replanting.• During maintenance of the road and associated infrastructure implement mitigation measures set for construction stage.• Ensure the implementation of the Operational Waste Management Plan.• Remove all materials, equipment, tools from the area after completion of works.	PIURR, PIURR Consultant	PIURR Information – included in reports to the Lenders	Consultation completed with the identified stakeholders per the SEP and results of consultations presented to PIURR and Lenders.

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
Operation					
		<ul style="list-style-type: none">Reinstate the sites disturbed during maintenance works, using species of local/regional provenance.			
390	Operational Waste Management Plan	<p>The Operational Waste Management Plan will:</p> <ul style="list-style-type: none">Include wastes generated at operational facilities (tunnel cabins, maintenance depots, etc.), by road users, and during maintenance operationsdescribe waste streams and estimated amounts of each,describe recycling / reuse methods for each material,identify the waste destinations and transport modes, including what materials are being segregated on site for reuse or recycling,specify responsibilities for managing and disposal of waste <p>Waste generated along the road</p> <ul style="list-style-type: none">Install sanitary facilities and waste bins in the rest areas along the road.Use bins fitted with lids to avoid scattering of litter and attraction of scavengers.Prohibit dumping of material or waste and undertake regular inspections.Keep a log of illegally dumped waste and ensure that the locations are regularly inspected.Ensure regular collections of wastes from roadside bins and also any illegally dumped wastes. For disposal of non-hazardous domestic waste, agreement with a solid Waste Management Company must be signed. <p>Waste from operational facilities</p> <ul style="list-style-type: none">Apply the Waste HierarchyInstall appropriate waste containers at all operational facilities.Segregate hazardous, non-hazardous and reusable waste streams.	Maintenance department of MoT	PIURR, CEP Information – included in reports to the Lenders.	Reduced waste-based pollution.

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
Operation					
		<ul style="list-style-type: none">Manage and dispose hazardous waste according to the type and the class of hazard.For disposal of non-hazardous domestic waste, agreement with a solid Waste Management Company must be signed.Agreement(s) with company / companies authorised for utilisation or disposal of hazardous waste must be signed. If none are available, measures for the selection of suitable sites, and processes for the safe disposal of hazardous waste must be set out and implemented.Provide bins and facilities at operational facilities for temporary storage of all waste streams. These facilities should be designed to prevent the escape of litter, liquids, odours or other contaminants / nuisance emissions.Remove waste generating during maintenance activities according to the type and hazard category.			
400	<ul style="list-style-type: none">Operational Air Quality Management Plan, including	<p>The Operational Air Quality Management Plan should include provisions to:</p> <ul style="list-style-type: none">Keep roadside vegetation intact.Check air quality in sensitive receptor locations seasonally. Pay particular attention to measurements in tunnel exits.Ensure of tunnel ventilation system is properly maintained.Filter air before exhaust to environment (tunnel sections).Apply the same mitigation measures during maintenance activities to reduce dust and emissions as the construction phase.	Maintenance department of MoT Tunnel operation staff	PIURR, CEP Information – included in reports to the Lenders.	Road vegetation maintained. Tunnel ventilation system operational.
410	Operational Noise Management Plan	<p>The Operational Noise Management Plan should include provisions to:</p> <ul style="list-style-type: none">Monitor noise levels at annual intervals and, depending on the results, implement noise abatement measures when the noise level exceed the acceptable limits / criteria during the operation phase.	Maintenance department of MoT	PIURR, CEP	Low number of post completion complaints.

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
Operation					
		<ul style="list-style-type: none">• Maintain the grievance redress mechanism to allow identification of other potential locations where noise protection may become necessary during the operation of the infrastructure. Where issues are raised, check the noise level in the location indicated by the complainant to verify the claim and develop relevant mitigation measures.• Depending on the results of noise monitoring and/or based on justified complaints, additional mitigation measures shall be considered as necessary, including<ul style="list-style-type: none">○ Reduction of vehicle speeds to reduce the noise levels○ Ban on truck driving at night time○ Noise-reducing porous asphalt road surfacing;○ Provision of noise barriers may also be considered for the long term.		Information – included in reports to the Lenders.	
420	Operational Soil Management Plan	<ul style="list-style-type: none">• Implement the Operational Soil Management Plan.• Monitor slopes, in particular after strong rains and snowmelt for possible traces of erosion.• Implement best practice for sediment / erosion control when undertaking repair/ maintenance works.• Analysis of soil following any intensive salt spreading during periods of high snow fall/ ice.• Keep vegetation strip between the edge of embankment and cultivated land plots.• Monitor soil quality for presence of heavy metals – Pb, Cd, Zn.	Maintenance department of MoT	PIURR, CEP Information – included in reports to the Lenders.	No degradation of soil quality.
430	Operational Climate Resilience Management Plan	Develop and implement an Operational Climate Resilience Management Plan, which will include updates on changes in physical conditions and their projections, and	Maintenance department of MoT	PIURR	Limiting damage due to climate change.

	Environmental Aspect / Concern	Proposed Mitigation Measures	Responsibility		Target / Indicator
			Implementation	Monitoring	
Operation					
		<p>which will specify requirements and processes (management framework) with respect to climate resilience.</p> <p>This shall include regular inspection across the project and especially after significant weather events such as flash floods (potentially damaging infrastructure in river valleys), intense rainfall events (potential mudslides), periods of long dry weather (due to dust). These inspections will be integrated with the Operational Maintenance Plan.</p>		<p>Information – included in reports to the Lenders.</p> <p>Maintenance Log.</p>	

8.8 Monitoring Plans

Table 78: Monitoring Plans – Pre-Construction Phase

Environmental Effects Monitoring Plan				
Aspects/Parameters to be Monitored	Location	Means of Monitoring	Frequency	Implementation Responsibility
Pre-construction/Site Preparation Phase				
Biodiversity (Note: Pre-construction surveys as per requirements included within the BMP)	Whole alignment (including access roads)	N/A	For the duration of the pre-construction phase	Contractor
Review and audit of all water pipes along the alignment	Whole alignment (including access roads)	Observation	Prior to construction	Contractor
Land acquisition and economic displacement audit	N/a	Observation	Prior to construction	Independent 3rd party

Table 79: Monitoring Plans – Construction Phase

Environmental Effects Monitoring Plan				
Aspects/Parameters to be Monitored	Location	Means of Monitoring	Frequency	Implementation Responsibility
Construction Phase				
Ambient air quality (Particulates PM10, PM2.5, CO, NOx, SO2)	Whole alignment (including access roads)	Instrumental measurement	Monthly and response to complaints	Contractor
Day time and night time noise levels dB(A)	Whole alignment (including access roads)	Instrumental measurement	Monthly and in response to complaints	Contractor

Environmental Effects Monitoring Plan				
Aspects/Parameters to be Monitored	Location	Means of Monitoring	Frequency	Implementation Responsibility
Construction Phase				
Day time and night time vibration levels dB(A)	Whole alignment (including access roads)	Instrumental measurement	Continuous and during blasting	Contractor
Surface water quality (turbidity, pH, conductivity, total Oil and Grease, COD)	Downstream of activities close to rivers or streams.	Analytical methods/ standards - ISO, USEPA or similar Observation	Bi-weekly during project activities implemented close to rivers or streams.	Contractor
Effluent monitoring (camp sewage treatment) (pH; Suspended Solids; BOD5; COD; Coliforms; Nitrate (NO3); Phosphate (PO4); Oil and Grease)	50 m upstream and 250 m downstream the point of discharge from camp effluent plants	Analytical methods/ standards - ISO, USEPA or similar Observation	At least weekly, and in accordance with manufacturer's instructions	Contractor
Subsidence	Tunnelling operations	Observation	Daily during tunnelling.	Contractor
Ground water level and quality		Instrumental measurement	Seasonally	Contractor
Vegetation	All work locations	Observation	Seasonally	Contractor
Biodiversity – as detailed within the BMP.	As detailed within the BMP	As detailed within the BMP	For the duration of the construction phase	Contractor
Subcontractor audits	N/a	Observation	Dependent on type and duration of activity	Contractor
Labour audit	All work locations	Observation	During the first month of the construction phase	PIURR

Environmental Effects Monitoring Plan				
Aspects/Parameters to be Monitored	Location	Means of Monitoring	Frequency	Implementation Responsibility
Construction Phase				
Gender Action Plan (GAP)	As detailed within the GAP	Observation and gender-sensitive indicators as detailed within the GAP	For the duration of the construction phase	PIURR Gender Specialist / Contractor / Specialist Consultant
Workplace inspections and audits to monitor the effectiveness of EHS control measures	All work locations	Observation	Monthly	PIURR / Engineer
Waste company audits	Site / waste disposal locations	Observation	Dependent on hazard nature of waste and frequency of use	Contractor
Blasting contractor audit, to ensure all approvals and authorisations are in place and good practices are applied	N/a	Observation	Prior to engagement of supplier	Contractor
Regular inspection of scaffolds by competent persons	All work locations with scaffolds	Observation	After installation, weekly or following modification of inclement weather	Contractor
Regular inspection of fall prevention devices.	All work locations	Observation	Before each use	Contractor
Regular inspection and testing of all lifting equipment, including all straps, chains, shackles, etc	All work locations	Observation	Dependent on type of equipment	Contractor
Inspection of dust control measures at concrete / asphalt plants	All work locations	Observation	Weekly	Contractor

Environmental Effects Monitoring Plan				
Aspects/Parameters to be Monitored	Location	Means of Monitoring	Frequency	Implementation Responsibility
Construction Phase				
Wind speed monitoring (for dust control purposes)	All work locations	Instrumental measurement	Daily and following significant increases in wind.	Contractor
Traffic and road conditions on construction site access roads and village access roads	Access roads	Observation	Dependent on traffic volumes	Contractor
Security patrols to prevent public access to hazardous areas	All work locations	Observation / cameras	Throughout construction	Contractor
Inspection of weather related damage to construction site, permanent and temporary assets	All work location (specifically exposed areas)	Observation	Throughout construction and specifically following significant weather events such as flash floods, mudflows and heavy snowfall, or long periods of dry weather	Contractor

Table 80: Monitoring Plans – Operational Phase

Operation (first year)				
Aspects/Parameters to be Monitored	Location	Means of Monitoring	Frequency	Implementation Responsibility
Ambient air quality (Particulates PM10, PM2.5, CO)	Locations indicated by complaints	Instrumental measurement	Quarterly In response to complaints	PIURR/ MoT

Operation (first year)				
Aspects/Parameters to be Monitored	Location	Means of Monitoring	Frequency	Implementation Responsibility
Day time and night time noise and vibration levels dB(A)	Locations indicated by complaints	Instrumental measurement	Quarterly and in other sites in response to complaints	PIURR/ MoT
Surface water quality monitoring pH; Suspended Solids; BOD5; COD; Coliforms; Nitrate (NO3); Phosphate (PO4); Oil and Grease	In watercourses receiving runoff from the road (50 m upstream and 250 m downstream the point of discharge)	Analytical methods/ standards - ISO, USEPA or similar Observation	Twice a year	PIURR/ MoT
Biodiversity –as detailed within the BMP	As detailed within the BMP	As detailed within the BMP	As detailed within the BMP	PIURR/ MoT
Slope stability monitoring for erosion	Whole alignment (including village access roads)	Observation	Twice a year and after heavy rain	PIURR/ MoT
Soil quality monitoring for heavy metals	Whole alignment	Analytical methods/ standards - ISO, USEPA or similar	Annually	PIURR/ MoT
Soil quality monitoring	Whole alignment	Analytical methods/ standards - ISO, USEPA or similar	following any intensive salt spreading	PIURR/ MoT
Maintenance depots inspections	Camps being converted to maintenance depots	Observation	Prior to conversion	PIURR/ MoT

Operation (first year)				
Aspects/Parameters to be Monitored	Location	Means of Monitoring	Frequency	Implementation Responsibility
Tunnel inspection and maintenance programme	Whole alignment	Observation Other methods as required	In line with appropriate Tajik and international standards	PIURR/ MoT
Maintenance regime for roads, barriers, bridges, drainage and safety features	Whole alignment (including village access roads)	Observation Other methods as required	In line with appropriate Tajik and international standards	PIURR/ MoT
Road safety audits	Whole alignment (including village access roads)	Observation	Six monthly	PIURR / MoT / Specialist consultant
Regular inspection of scaffolds by competent persons	All work locations with scaffolds	Observation	After installation, weekly or following modification of inclement weather	PIURR/ MoT
Regular inspection of fall prevention devices.	All work locations	Observation	Before each use	PIURR/ MoT
Regular inspection and testing of all lifting equipment	All work locations	Observation	Dependent on type of equipment	PIURR/ MoT
Inspection of weather related damage to assets	Whole alignment (specifically infrastructure in river valleys)	Observation	Following significant weather events such as flash floods, mudflows and heavy snowfall, and following long periods of dry weather (due to dust)	PIURR / MoT

8.9 Estimated Costs for Environmental and Social Protection Measures

836. Estimated costs for implementation of the environmental and social measures are provided in Table 81.

Table 81: Costs Associated with Environmental Protection Elements of the Project

	Element	Description	Cost	Unit	No	Section 1: Western ADB ^{Note 1}	Section 2: Eastern EBRD ^{Note 9}	Section 3: Long Bridge AIIB ^{Note 1}
D1	Already included in due diligence							
C1	Construction Supervision Consultant ^{Note 2}	Senior Environmental Specialist (international)	USD16,000	Person Months	3	USD48,000	Tbc	USD56,000
C2		Senior Occupational Health and Safety Specialist (International)	USD18,000		4	USD72,000	Tbc	USD81,000
		Environmental Specialist (National)	USD2,500		40	USD100,000	Tbc	USD110,000
C3		Occupational Health and Safety Specialist (National)	USD2,500		40	USD100,000	Tbc	USD110,000

	Element	Description	Cost	Unit	No	Section 1: Western ADB ^{Note 1}	Section 2: Eastern EBRD ^{Note 9}	Section 3: Long Bridge AIIB ^{Note 1}
C4	Project Management Consultant ^{Note 3}	Environmental Monitor (National)	USD2,500	Person Months	20	USD 50,000	Tbc	USD 52,500
C5	Traffic Noise Barriers ^{Note 4}	All costs associated with construction of 22.9Km of 4.5mm high barrier (steel acoustic barrier)	USD26	meters	22.9km	USD297,700	Tbc	n/a
C6	Environmental Monitoring ^{Note 5}	Noise (5 sites) ^{Note 6}	USD1,500	Set - each 6 months –(pre construction and 6m & 12m)	8	USD12,000	Tbc	n/a
C7		Air Quality ^{Note 7} (5 sites)	USD3,000		8	USD24,000	Tbc	n/a
C8		Water Quality ^{Note 8} (11 sites)	USD615		8	USD4,920	Tbc	USD4,920
C9		Emissions monitoring for construction vehicles and plant	Being determined for local Tajikistan vehicle testing station	One off	1	tbc	tbc	n/a
O1	Environmental	Noise ^{Note 6} (5 sites)	USD1,500	Set - Annual for 2 years	2	USD3,000	Tbc	n/a
O2	Monitoring ^{Note 4}	Air Quality ^{Note 7} (5 sites)	USD3,000		2	USD6,000	Tbc	n/a

	Element	Description	Cost	Unit	No	Section 1: Western ADB ^{Note 1}	Section 2: Eastern EBRD ^{Note 9}	Section 3: Long Bridge AIIB ^{Note 1}
O3		Water Quality (11 sites)	USD615	post construction	2	USD1,230	Tbc	USD1,230
	Sub TOTAL					718,150	Tbc	415,650
	GRAND TOTAL					USD1,016,850		

Note 1) Project duration of section 1, and 2 is 40 months (Almost 3.5 years) and for section 3 is 42 months (3.5 years)

Note 2) Based on an International environmental specialist working in Construction Supervision Consultant (CSC) team for three person months over the project, an International Occupational Health and Safety Specialist for four person months over the project and National consultant as full time appointment over 40 months

Note 3) National Environmental; Consultant employed within the PIURR as a Project Management Consultant half time over the project duration to audit performance, provide training and prepare 6 monthly monitoring report on behalf of MoT for ADB

Note 4) This is a tentative cost. Actual cost will be determined during the detailed design stage. Cost represents material for a 4.5m high perforated steel acoustic noise barrier derived from the average cost of online retailers (<https://www.alibaba.com/showroom/noise-barrier.html> accessed 26 Aug 2019) . \$USD26 for panel 1.5m high x 3m wide. No cost for labour or plant

Note 5) Environmental monitoring costs based on EIS due diligence project monitoring carried out in Q3 2018

Note 6) Noise monitoring parameters: dB(A) 24 hrs

Note 7 Air Quality Monitoring parameters: CO, CO₂, NO, NO₂, SO₂, Mechanical dust

Note 8) Costs of environmental protection included in contractor rates (i.e. no BoQ line item) not included (e.g. dust suppression, noise mitigation, waste management and operation of camps, etc.)

Note 9) The exact costs associated with the provision of these services will be determined during the procurement phase. EBRD is not required to disclose allocation budgets within the EIA.

9 Conclusions and Recommendations

9.1 Conclusions

837. This Environmental Impact Assessment (EIA) has been prepared for the Obigarm to Nurobod Road Project, Tajikistan and examined the implementation of the rehabilitation and construction. The EIA envisages that all the potential adverse and beneficial social and environmental impacts of the proposed final design option will be prevented and/or mitigated adequately and the positive impacts strengthened in the result of implementation of mitigation and enhancement measures identified in the Environmental Management Plan.
838. The positive socio-economic and environmental effects of the project outweigh the likely environmental and social risks associated with its implementation. Implementation of the project will improve efficiency of transportation; provide reliable, speedy and safe commute and connection; decrease operation and maintenance costs for road infrastructure; significantly reduce risk of accidents; reduce vehicle maintenance costs for both commuters and cargo transporters; contribute to improved social and economic welfare of the local population, both men and women.
839. Based on site inspections it has been concluded that project components do not encroach upon ecologically sensitive areas. They are located within the boundaries / footprint of the existing road corridor. Decisions are still needed on the location of worksites to house the work force, construction equipment and materials but there are suitable sites available along the alignment where camps could be established that would not adversely impact on existing sensitive receivers.
840. Potential environmental impacts were identified in relation to design, location, construction and operation of the improved infrastructure and mitigation measures have been developed to reduce all negative impacts to acceptable levels.
841. Overall the proposed project is unlikely to cause any adverse environmental impacts. This is due to the following findings:
- Most of the alignment will be rehabilitated within the footprint of an existing alignment constructed in the Soviet era.
 - There are no sites of cultural or heritage significance within the area of influence of the alignment.
 - There are no ecologically sensitive sites or protected areas falling within the alignment or its zone of influence
 - The road realignments will not include tight bends, overstep hills sections and improve sight lines making vehicle movements more efficient than the existing M41 alignment.
 - The road improvements incorporate road safety elements within the alignment
 - Where appropriate slopes will be cut back to more stable angles and incorporate landslip protection improving driver safety.
 - Construction and operation of the project is likely to give rise to nil, negligible or at worst, minor temporary environmental impacts that can be easily mitigated to acceptable levels.

842. Project specific traffic noise modelling has been carried out that indicates exceedence of ICF guidelines from night-time traffic movements at many locations and some day-time exceedences at a limited number of locations. These impact needs to be confirmed by on-site confirmation of the status of structures identified in the assessment. Mitigation may need to consider: restrictions on night-time theavy goods vehicle movements, localised noise barriers, speed restrictions or noise limiting road surfacing through settled areas.
843. An Environmental Management Plan (EMP) has been prepared for the project. The EMPs are included as part of this EIA and include (i) mitigation measures for potential environmental impacts during implementation, (ii) environmental monitoring program, and (iii) the responsible entities for mitigation, monitoring, and reporting.
844. Mitigation will be assured by a program of environmental monitoring to be conducted during the construction stages. The environmental monitoring program will ensure that all mitigation measures proposed in the EMPs are implemented, and will determine whether the environment is protected as intended. Any requirements for remedial action will be reported to the ADB.
845. Project stakeholders were consulted during preparation of the EIA and invited to express any environmental and social concerns they had regarding the project. No significant environmental and social concerns were raised and all stakeholders consulted strongly support the project and are looking forward to the benefits of the improved road corridor. The EIA will be made available at public locations and will be disclosed to a wider audience via the ADB website. The consultation process will be continued during project implementation to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation
846. Environmental and social benefits of the investment components and long-term project objectives far outweigh the minor and temporary inconveniences that will arise during project implementation. Provided the EMPs are properly implemented there will be no unacceptable impacts arising from the project.
847. This EIA including EMP are considered sufficient to meet the environmental assessment requirements of ADB and Government of Tajikistan.

10 Annex 1: Document List / References

See Volume 2

11 Annex 2: Preliminary Data Analysis Under the Tajikistan OVOS

See Volume 2

12 Annex 3: Geological Processes and Mitigations

See Volume 2

13 Annex 4: Ambient Noise Monitoring Data

See Volume 2

14 Annex 5: Community Consultations

See Volume 2

15 Annex 6: Risk Management Matrix

See Volume 2

16 Annex 7: Traffic Noise Impact Assessment

Annex 7a Traffic Noise Impact Assessment Text

Annex 7b: Soundplan Outputs for 2018, 2025 and 2033

See Volume 2

17 Annex 8: Community Access Roads – Rehabilitation Works

See Volume 2

18 Annex 9: Air Emission Assessment

See Volume 2