

Baljuvon – Sari Khosor Road Project ESIA

Contract No. 2025.015035



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Table of Contents

I.	INTRODUCTION AND BACKGROUND	16
1.1.	BACKGROUND & CONTEXT.....	16
1.2.	PROJECT COMPONENTS.....	16
1.3.	PROJECT OBJECTIVES	16
1.4.	PURPOSE AND OBJECTIVES OF THE ESIA	16
1.5.	LINKS TO OTHER DOCUMENTS.....	17
1.6.	STRUCTURE OF THE ESIA	18
2.	PROJECT DESCRIPTION.....	19
2.1.	OVERVIEW.....	19
2.1.1.	LOCATION AND REGIONAL CONTEXT	19
2.1.2.	STRATEGIC ROLE IN NATIONAL AND REGIONAL TRANSPORT NETWORK.....	22
2.1.3.	KEY COMPONENTS OF THE PROJECT	22
2.2.	EXISTING GENERAL FEATURES.....	23
2.2.1.	DRAINAGE AND HYDRAULIC AND GEOTECHNICAL CONDITIONS.....	23
2.3.	SCOPE OF WORKS	27
2.3.1.	GENERAL DESIGN APPROACH	27
2.3.2.	KEY TECHNICAL PARAMETERS.....	28
2.3.3.	PAVEMENT, EARTHWORKS AND ROAD FORMATION	28
2.3.4.	CULVERTS, DRAINAGE, AND HYDRAULIC STRUCTURES	36
2.3.5.	RETAINING WALLS, SHORE PROTECTION, AND RIVER TRAINING WORKS	40
2.3.6.	CONSTRUCTION MATERIALS, BORROW AREAS AND SPOIL DISPOSAL	43
2.3.7.	CONSTRUCTION CAMPS, ANCILLARY FACILITIES, AND ROADSIDE SERVICE STRUCTURES	52
2.3.8.	CONSTRUCTION WORKFORCE.....	54
2.3.9.	CONSTRUCTION PLANT AND EQUIPMENT.....	54
2.4.	PROJECT PHASES.....	55
2.4.1.	PRE-CONSTRUCTION	55
2.4.2.	CONSTRUCTION	56
2.4.3.	OPERATION AND MAINTENANCE.....	57
2.5.	ASSOCIATED FACILITIES	58
2.5.1.	IDENTIFICATION OF ASSOCIATED FACILITIES.....	58
3.	POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK	59
3.1	GENERAL.....	59
3.2	NATIONAL POLICY AND LEGAL FRAMEWORK.....	59
3.2.1	GENERAL FRAMEWORK.....	59
3.2.2	LAW ON ENVIRONMENTAL PROTECTION	61
3.2.3	ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT	61
3.2.4	PUBLIC PARTICIPATION AND GRIEVANCES	63
3.2.5	LAW ON THE PERMIT SYSTEM (2023)	64
3.2.6	LAW OF REPUBLIC OF TAJIKISTAN ON APPEALS OF INDIVIDUALS AND LEGAL ENTITIES (FROM JULY 23, 2016, №1339)	64
3.2.7	LAW ON ENVIRONMENTAL INFORMATION.....	64
3.2.8	LAW ABOUT CULTURE.....	64
3.3	LABOUR AND WORKING CONDITIONS.....	64
3.3.1	LABOUR CODE (2016)	64
3.3.2	OCCUPATIONAL HEALTH AND SAFETY	65
3.3.3	LAW ON FIRE SAFETY	65
3.3.4	STATE ENVIRONMENTAL PROGRAM 2009–2019	65
3.3.5	RESETTLEMENT AND LAND ACQUISITION	66
3.3.6	TYPES OF LAND OWNERSHIP AND LAND USE ALLOCATION	66
3.3.7	KEY ACTS	66
3.4	GENDER POLICY FRAMEWORK	68
3.5	IMPLEMENTATION AND COMPLIANCE IN TAJIKISTAN.....	69
3.6	ENVIRONMENTAL PERMITS AND LICENCES.....	69
3.7	NATIONAL ADMINISTRATIVE FRAMEWORK	70



3.8	INTERNATIONAL AGREEMENTS AND CONVENTIONS	71
3.9	REGULATIONS AND STANDARDS	72
3.9.1	AIR QUALITY AND EMISSIONS	72
3.9.2	WATER QUALITY STANDARDS	72
3.9.3	NOISE	74
3.9.4	VIBRATION	75
3.10	LENDER REQUIREMENTS	76
3.10.1	EBRD E&S POLICY (2024)	76
3.10.2	APPLICABLE ENVIRONMENTAL AND SOCIAL REQUIREMENTS	76
3.10.3	EU SUBSTANTIVE ENVIRONMENTAL STANDARDS.....	77
3.10.4	IFC EHS GUIDELINES	78
3.10.5	HUMAN RIGHTS	78
3.11	GAP ANALYSIS: EBRD ESRs AND NATIONAL LEGAL FRAMEWORK	78
4.	ANALYSIS OF ALTERNATIVES	87
4.1.	OVERVIEW OF ALTERNATIVES	87
4.2.	WITHOUT PROJECT SCENARIO	87
4.3.	ROUTE AND CORRIDOR ALTERNATIVES	87
4.4.	DESIGN STANDARDS AND LEVEL OF INTERVENTION	89
4.5.	SLOPE AND RIVERBED PROTECTION.....	90
4.6.	BRIDGE STRUCTURE ALTERNATIVES.....	90
4.7.	ALTERNATIVES TO AVOID AND MINIMISE LAND ACQUISITION AND RESETTLEMENT IMPACTS	92
4.8.	SUMMARY	93
5.	METHODOLOGY	95
5.1.	SCOPING OF IMPACTS	95
5.2.	ASSESSMENT BOUNDARIES.....	95
5.3.	ESIA METHODOLOGY	100
5.3.1.	DESKTOP DATA REVIEW	100
5.3.2.	SITE SURVEYS AND BASELINE MONITORING	101
5.4.	IMPACT ASSESSMENT METHODOLOGY	101
5.5.	STAKEHOLDER ENGAGEMENT	103
6.	BASELINE CONDITIONS	104
6.1.	PHYSICAL ENVIRONMENT.....	104
6.1.1.	TEMPERATURE	105
6.1.2.	PRECIPITATION	106
6.1.3.	WIND	107
6.1.4.	HISTORICAL CLIMATE TRENDS	108
6.1.5.	NATURAL HAZARDS.....	109
6.1.6.	TOPOGRAPHY.....	115
6.1.7.	SOILS AND GEOLOGY	121
6.1.8.	WATER RESOURCES AND HYDROLOGY	124
6.1.9.	AIR QUALITY AND NOISE	132
6.2.	BIOLOGICAL ENVIRONMENT	135
6.2.1.	HABITATS AND LAND COVER	135
6.2.2.	PROTECTED AREAS.....	151
6.2.3.	FLORA AND FAUNA	156
6.3.	SOCIO-ECONOMIC ENVIRONMENT	176
6.3.1.	POPULATION AND SETTLEMENTS.....	176
6.3.2.	LAND USE	180
6.3.3.	LIVELIHOODS AND LOCAL ECONOMY	181
6.3.4.	ACCESS TO SERVICES.....	183
6.3.5.	GENDER.....	187
6.3.6.	VULNERABLE GROUPS.....	189
6.3.7.	TOURISM	191
6.3.8.	CULTURAL HERITAGE	193
6.3.9.	ROAD SAFETY.....	203
7.	IMPACT ASSESSMENT AND MITIGATION AND MANAGEMENT MEASURES	206
7.1.	SCOPING	206



7.2.	IMPACTS AND MITIGATION	213
7.3.	AIR QUALITY	213
7.3.1.	PROJECT ACTIVITIES WITH POTENTIAL TO EMIT ATMOSPHERIC POLLUTANTS AND GREENHOUSE GASES	213
7.3.2.	SENSITIVE RECEPTORS.....	214
7.3.3.	POTENTIAL IMPACTS.....	214
7.3.4.	IMPACT SUMMARY AND ASSESSMENT OF SIGNIFICANCE	216
7.3.5.	MITIGATION AND MANAGEMENT MEASURES.....	218
7.3.6.	RESIDUAL IMPACTS	220
7.3.7.	MONITORING.....	220
7.4.	NATURAL HAZARDS	222
7.4.1.	PROJECT ACTIVITIES WITH POTENTIAL TO BE AFFECTED BY NATURAL HAZARDS.....	222
7.4.2.	SENSITIVE RECEPTORS.....	222
7.4.3.	POTENTIAL IMPACTS.....	223
7.4.4.	IMPACT SUMMARY AND ASSESSMENT OF SIGNIFICANCE	226
7.4.5.	MITIGATION AND MANAGEMENT MEASURES.....	228
7.4.6.	RESIDUAL IMPACTS	230
7.4.7.	MONITORING.....	231
7.5.	HYDROLOGY.....	232
7.5.1.	PROJECT ACTIVITIES WITH POTENTIAL TO RESULT IN IMPACTS TO HYDROLOGY	233
7.5.2.	SENSITIVE RECEPTORS.....	233
7.5.3.	POTENTIAL IMPACTS.....	234
7.5.4.	IMPACT SUMMARY AND ASSESSMENT OF SIGNIFICANCE	237
7.5.5.	MITIGATION AND MANAGEMENT MEASURES.....	240
7.5.6.	RESIDUAL IMPACTS	242
7.5.7.	MONITORING.....	243
7.6.	CLIMATE CHANGE	245
7.6.1.	CLIMATE RISKS AND ADAPTATION ASSESSMENT	245
7.6.2.	SENSITIVE RECEPTORS.....	248
7.6.3.	POTENTIAL IMPACTS.....	249
7.6.4.	IMPACT SUMMARY AND ASSESSMENT OF SIGNIFICANCE	252
7.6.5.	MITIGATION AND MANAGEMENT MEASURES.....	255
7.6.6.	RESIDUAL IMPACTS	256
7.6.7.	MONITORING.....	257
7.7.	SOILS AND GEOLOGY.....	258
7.7.1.	PROJECT ACTIVITIES WITH POTENTIAL TO RESULT IN IMPACTS TO SOILS AND GEOLOGY	258
7.7.2.	SENSITIVE RECEPTORS.....	259
7.7.3.	POTENTIAL IMPACTS.....	259
7.7.4.	IMPACT SUMMARY AND ASSESSMENT OF SIGNIFICANCE	262
7.7.5.	MITIGATION AND MANAGEMENT MEASURES.....	264
7.7.6.	RESIDUAL IMPACTS	265
7.7.7.	MONITORING.....	266
7.8.	NOISE AND VIBRATION	267
7.8.1.	PROJECT ACTIVITIES WITH POTENTIAL TO RESULT IN NOISE AND VIBRATION IMPACTS	267
7.8.2.	SENSITIVE RECEPTORS.....	268
7.8.3.	POTENTIAL IMPACTS.....	269
7.8.4.	IMPACT SUMMARY AND ASSESSMENT OF SIGNIFICANCE	273
7.8.5.	MITIGATION AND MANAGEMENT MEASURES.....	275
7.8.6.	RESIDUAL IMPACTS	277
7.8.7.	MONITORING.....	278
7.9.	PROTECTED AREAS	280
7.9.1.	PROJECT ACTIVITIES WITH POTENTIAL TO RESULT IN IMPACTS TO PROTECTED AREAS	280
7.9.2.	SENSITIVE RECEPTORS.....	280
7.9.3.	POTENTIAL IMPACTS.....	281
7.9.4.	IMPACT SUMMARY AND ASSESSMENT OF SIGNIFICANCE	284
7.9.5.	MITIGATION AND MANAGEMENT MEASURES.....	286
7.9.6.	RESIDUAL IMPACTS	287
7.9.7.	MONITORING.....	287



7.10.	HABITAT	289
7.10.1.	PROJECT ACTIVITIES WITH POTENTIAL TO RESULT IN IMPACTS ON VALUED HABITATS	289
7.10.2.	SENSITIVE RECEPTORS.....	290
7.10.3.	POTENTIAL IMPACTS.....	291
7.10.4.	IMPACT SUMMARY AND ASSESSMENT OF SIGNIFICANCE	293
7.10.5.	MITIGATION AND MANAGEMENT MEASURES.....	296
7.10.6.	RESIDUAL IMPACTS	297
7.10.7.	MONITORING.....	298
7.11.	FLORA AND FAUNA	299
7.11.1.	PROJECT ACTIVITIES WITH POTENTIAL TO RESULT IN SIGNIFICANT EFFECTS ON FLORA AND FAUNA	299
7.11.2.	SENSITIVE RECEPTORS.....	300
7.11.3.	POTENTIAL IMPACTS.....	305
7.11.4.	IMPACT SUMMARY AND ASSESSMENT OF SIGNIFICANCE	310
7.11.5.	MITIGATION AND MANAGEMENT MEASURES.....	316
7.11.6.	RESIDUAL IMPACTS	319
7.11.7.	MONITORING.....	321
7.12.	LAND USE & LIVELIHOODS.....	323
7.12.1.	PROJECT ACTIVITIES WITH POTENTIAL TO RESULT IN LAND USE AND LIVELIHOODS IMPACTS	323
7.12.2.	SENSITIVE RECEPTORS.....	323
7.12.3.	POTENTIAL IMPACTS.....	324
7.12.4.	IMPACT SUMMARY AND ASSESSMENT OF SIGNIFICANCE	328
7.12.5.	MITIGATION AND MANAGEMENT MEASURES.....	330
7.12.6.	RESIDUAL IMPACTS	330
7.12.7.	MONITORING.....	331
7.13.	GENDER AND VULNERABLE PEOPLE	333
7.13.1.	PROJECT ACTIVITIES WITH POTENTIAL TO RESULT IN IMPACTS ON GENDER AND VULNERABLE PEOPLE	333
7.13.2.	SENSITIVE RECEPTORS.....	333
7.13.3.	POTENTIAL IMPACTS.....	334
7.13.4.	IMPACT SUMMARY AND ASSESSMENT OF SIGNIFICANCE	337
7.13.5.	MITIGATION AND MANAGEMENT MEASURES.....	340
7.13.6.	RESIDUAL IMPACTS	341
7.13.7.	MONITORING.....	342
7.14.	COMMUNITY HEALTH AND SAFETY	343
7.14.1.	PROJECT ACTIVITIES WITH POTENTIAL TO RESULT IN COMMUNITY HEALTH AND SAFETY IMPACTS	343
7.14.2.	SENSITIVE RECEPTORS.....	344
7.14.3.	POTENTIAL IMPACTS.....	344
7.14.4.	IMPACT SUMMARY AND ASSESSMENT OF SIGNIFICANCE	346
7.14.5.	MITIGATION AND MANAGEMENT MEASURES.....	348
7.14.6.	RESIDUAL IMPACTS	349
7.14.7.	MONITORING.....	350
7.15.	ROAD SAFETY.....	352
7.15.1.	PROJECT ACTIVITIES WITH POTENTIAL TO AFFECT ROAD SAFETY	352
7.15.2.	SENSITIVE RECEPTORS.....	352
7.15.3.	POTENTIAL IMPACTS.....	353
7.15.4.	IMPACT SUMMARY AND ASSESSMENT OF SIGNIFICANCE	355
7.15.5.	MITIGATION AND MANAGEMENT MEASURES.....	361
7.15.6.	RESIDUAL IMPACTS	362
7.15.7.	MONITORING.....	364
7.16.	LABOUR AND WORKING CONDITIONS	365
7.16.1.	PROJECT ACTIVITIES AFFECTING LABOUR AND WORKING CONDITIONS	365
7.16.2.	SENSITIVE RECEPTORS.....	366
7.16.3.	POTENTIAL IMPACTS.....	366
7.16.4.	IMPACT SUMMARY AND ASSESSMENT OF SIGNIFICANCE	367
7.16.5.	MITIGATION AND MONITORING MEASURES.....	369
7.16.6.	RESIDUAL IMPACTS	370
	MONITORING	371
7.17.	OCCUPATIONAL HEALTH AND SAFETY	372



7.17.1.	PROJECT ACTIVITIES GENERATING OHS RISKS	372
7.17.2.	SENSITIVE RECEPTORS.....	373
7.17.3.	POTENTIAL IMPACTS.....	373
7.17.4.	IMPACT SUMMARY AND ASSESSMENT OF SIGNIFICANCE	375
7.17.5.	MITIGATION AND MONITORING MEASURES.....	378
7.17.6.	RESIDUAL IMPACTS	379
7.17.7.	MONITORING.....	380
7.18.	WASTE MANAGEMENT & SPOIL DISPOSAL	382
7.18.1.	PROJECT ACTIVITIES WITH POTENTIAL TO RESULT IN GENERATION OF WASTE.....	382
7.18.2.	SENSITIVE RECEPTORS.....	383
7.18.3.	POTENTIAL IMPACTS.....	383
7.18.4.	IMPACT SUMMARY AND ASSESSMENT OF SIGNIFICANCE	385
7.18.5.	MITIGATION AND MANAGEMENT MEASURES.....	388
7.18.6.	RESIDUAL IMPACTS	389
7.18.7.	MONITORING.....	390
7.19.	CULTURAL HERITAGE	392
7.19.1.	PROJECT ACTIVITIES WITH POTENTIAL TO AFFECT CULTURAL HERITAGE	392
7.19.2.	SENSITIVE RECEPTORS.....	393
7.19.3.	POTENTIAL IMPACTS.....	394
7.19.4.	IMPACT SUMMARY AND ASSESSMENT OF SIGNIFICANCE	396
7.19.5.	MITIGATION AND MANAGEMENT MEASURES.....	398
7.19.6.	RESIDUAL IMPACTS	399
7.19.7.	MONITORING.....	400
7.20.	COMMUNITY INFRASTRUCTURE	401
7.20.1.	PROJECT ACTIVITIES WITH POTENTIAL TO AFFECT COMMUNITY INFRASTRUCTURE.....	401
7.20.2.	SENSITIVE RECEPTORS.....	402
7.20.3.	POTENTIAL IMPACTS.....	403
7.20.4.	IMPACT SUMMARY AND ASSESSMENT OF SIGNIFICANCE	405
7.20.5.	MITIGATION AND MANAGEMENT MEASURES.....	410
7.20.6.	RESIDUAL IMPACTS	411
7.20.7.	MONITORING.....	412
8.	STAKEHOLDER ENGAGEMENT	415
8.1.	OVERVIEW OF THE CONSULTATION PROCESS	415
8.2.	STAKEHOLDER ENGAGEMENT UNDERTAKEN TO DATE	416
8.3.	PLANNED STAKEHOLDER ENGAGEMENT	418
8.4.	INFORMATION DISCLOSURE	421
8.5.	GRIEVANCE REDRESS MECHANISM	422
8.5.1.	PURPOSE AND PRINCIPLES	422
8.5.2.	TYPES OF GRIEVANCES AND ACCESS POINTS	423
8.5.3.	PROCEDURES AND SERVICE STANDARDS	423
8.5.4.	ESCALATION, SEA/SH HANDLING AND WORKER GRM	423
8.5.5.	GRM MONITORING AND REPORTING	424
8.5.6.	RESOURCES AND RESPONSIBILITIES	424
8.5.7.	SEP MONITORING AND REPORTING	424
9.	ESIA IMPLEMENTATION	425
9.1.	OVERVIEW AND INSTITUTIONAL STRUCTURE	425
9.2.	PIURR.....	426
9.2.1.	GENERAL RESPONSIBILITIES.....	426
9.2.2.	NATIONAL PERMITTING AND STATE ECOLOGICAL EXPERTISE	426
9.2.3.	CESMP AND SUB-PLAN REVIEW AND APPROVAL.....	426
9.2.4.	LAND ACQUISITION AND RESETTLEMENT	427
9.2.5.	STAKEHOLDER ENGAGEMENT AND GRM OVERSIGHT.....	427
9.2.6.	REPORTING TO EBRD.....	427
9.2.7.	INDEPENDENT COMPLIANCE AUDIT	428
9.2.8.	CATEGORY 1 NON-COMPLIANCE	428
9.2.9.	STAFFING	428
9.3.	ENGINEER.....	429



9.3.1.	CESMP AND SUB-PLAN REVIEW	429
9.3.2.	NON-CONFORMANCE REPORTING SYSTEM.....	429
9.3.3.	SITE INSPECTIONS	429
9.3.4.	CORRECTIVE ACTIONS	429
9.3.5.	STOP WORK AUTHORITY	430
9.3.6.	DESIGN APPROVALS AND TECHNICAL OVERSIGHT	430
9.3.7.	AUDITS	430
9.3.8.	MONTHLY REPORTING AND MEETINGS	430
9.3.9.	SUPERVISION MISSIONS	430
9.3.10.	STAFFING	431
9.4.	CONTRACTOR	431
9.4.1.	CESMP PREPARATION AND MAINTENANCE.....	431
9.4.2.	STAFFING	431
9.4.3.	CONTRACTORS SUB-CONTRACTORS.....	431
9.4.4.	PERMITS AND LEGAL COMPLIANCE	432
9.4.5.	MONTHLY REPORTING	432
9.4.6.	INCIDENT NOTIFICATION	432
9.4.7.	COSTS	432
9.5.	SUMMARY	432
10.	CONCLUSIONS AND RECOMMENDATIONS	436
10.1.	CONCLUSIONS.....	436
10.2.	RECOMMENDATIONS.....	436

List of Tables

Table 1: Summary of Geohazard Types and Distribution Along the BSK Corridor	24
Table 2: Geohazard Field Observations and Photo Log.....	25
Table 3: List of Bridges Along the BSK Road	39
Table 4: Earthworks Material Balance	44
Table 5: Proposed Borrow Reserves	44
Table 6: Identified Spoil Disposal Sites	45
Table 7: Preliminary Borrow Pit Screening	51
Table 8: Relevant E&S Laws of Tajikistan.....	59
Table 9: Indicative List of Permits and Licenses Required for the Project.....	69
Table 10: Air Quality Standards — Tajikistan and EU Comparison	72
Table 11: Water Quality Standards — Tajikistan and EU Comparison	73
Table 12: EU Urban Wastewater Treatment Directive (91/271/EEC) — Indicative Discharge Standards	73
Table 13: Noise Standards Comparison — Tajikistan, IFC and EU END	74
Table 14: Guideline Values for Vibration Velocity to be Used When Evaluating the Effects of Short-term and Long-term Vibration on Structures.....	75
Table 15: Applicable EBRD Standards.....	76
Table 16: EBRD ESRs and National Legal Framework	80
Table 17: Summary of Alternatives Analysis	94
Table 18: Environmental and Social Areas of Influence by Topic	95
Table 19: Baseline Site Surveys and Monitoring Activities	101
Table 20: Impact Significance Assessment Criteria	102
Table 21: Mean Monthly Air Temperatures at Meteorological Stations Relevant to the BSK Corridor (°C)	105
Table 22: Summary of Key Observed Climate Parameters for the BSK Corridor Area	106
Table 23: Maximum Wind Speeds at Meteorological Stations Relevant to the BSK Corridor	107
Table 24: Summary of Topographic Characteristics by Corridor Zone	120
Table 25: Principal Soil Units along the BSK Corridor	122
Table 26: Principal Tributary Catchments Crossing the BSK Corridor	127
Table 27: Baseline Water Quality Sampling Locations (July 2023)	128
Table 28: Summary of Baseline Suspended Solids Results (July 2023).....	130
Table 29: Summary of Baseline Air Quality Measurements — Average Values by Location (July 2023)	132
Table 30: Baseline Noise Measurement Results (July 2023)	134

Table 31: Land Cover Types within 1 km Buffer of the Project Corridor	135
Table 32: Notable Species Present within sari Khosor Park	153
Table 33: Red Data Book Plant Species with Confirmed or Potential Occurrence in the Project Area	160
Table 34: Sampling locations and water quality conditions	163
Table 35: Shurobdaryo in spring flood condition showing the wide, braided, unvegetated gravel bar system — Priority Biodiversity Feature habitat types C3.62 (Unvegetated River Gravel Banks) and C3.55 (Sparsely Vegetated River Gravel Banks). Lower	164
Table 36: Fish Species Recorded	165
Table 37: Invertebrates.....	166
Table 38: Reptiles	168
Table 39: Settlements Along the BSK Corridor by Jamoat	176
Table 40: Household Size Distribution.....	177
Table 41: Age Profile of the Directly Affected Population	178
Table 42: Affected Land Parcels by Land Type	180
Table 43: Land Tenure Profile of Affected Parcels.....	181
Table 44: Monthly Household Income by Source	182
Table 45: Monthly Household Expenditure by Category (Mean, Reporting Households)	183
Table 46: Baseline Utility Access — Directly Affected Households (n=98)	187
Table 47: Education Level of Household Heads.....	187
Table 48: Vulnerability Profile of Directly Affected Parties	189
Table 49: Age Profile of Household Heads	190
Table 50: Types of Tangible and Intangible Cultural Heritage Resources	193
Table 51: Khatlon Region Archaeological Context.....	195
Table 52: Typical Religious Activities Observed at Rural Mosques in Tajikistan.....	200
Table 53: UNESCO Listed Intangible Cultural Heritage Practiced in Tajikistan	201
Table 54: Projected Traffic Flows on the BSK Corridor (AADT, vpd).....	205
Table 55: Scoping Table	207
Table 56: Impacts and Significance — Air Quality.....	216
Table 57: Residual Impacts — Air Quality	220
Table 58: Monitoring — Air Quality	220
Table 59: Impacts and Significance — Natural Hazards	226
Table 60: Residual Impacts — Natural Hazards.....	230
Table 61: Monitoring — Natural Hazards.....	231
Table 62: Impacts and Significance — Hydrology	237
Table 63: Residual Impacts — Hydrology.....	242
Table 64: Monitoring — Water Resources and Hydrology.....	244
Table 65: CRA Main Findings	246
Table 66: Impacts and Significance — Climate Change.....	252
Table 67: Residual Impacts — Climate Change	256
Table 68: Monitoring — Climate Change	257
Table 69: Impacts and Significance — Soils and Geology	262
Table 70: Residual Impacts — Soils and Geology	265
Table 71: Monitoring — Soils and Geology	266
Table 72: Typical Noise Levels	269
Table 73: Predicted Noise Levels	270
Table 74: Impacts and Significance — Noise and Vibration	273
Table 75: Residual Impacts — Noise and Vibration	277
Table 76: Monitoring — Noise and Vibration	278
Table 77: Impacts and Significance — Protected Areas	284
Table 78: Residual Impacts - Protected Areas	287
Table 79: Monitoring — Protected Areas	287
Table 80: Impacts and Significance — Habitats	293
Table 81: Residual Impacts — Habitats.....	297
Table 82: Monitoring — Habitat	298
Table 83: PBF Assessment	301
Table 84: Impacts and Significance — Flora and Fauna	311
Table 85: Residual Impacts — Flora and fauna	319

Table 86: Monitoring – Flora and Fauna.....	321
Table 87: Affected Land Parcels by Land Type (Preliminary RP Data, 2026)	324
Table 88: Baseline vs Post-Project Travel Times for Representative Routes.....	325
Table 89: Indicative Trip Frequency by Economic Purpose	326
Table 90: Impacts and Significance – Land Use and Livelihoods	328
Table 91: Residual Impacts – Land Use and Livelihoods.....	330
Table 92: Monitoring – Land Use and Livelihoods.....	331
Table 93: Operational-phase beneficiaries by subsection, jamoat and vulnerable category	335
Table 94: Impacts and Significance – Gender and Vulnerable People	337
Table 95: Residual Impacts – Gender and Vulnerable People	341
Table 96: Monitoring – Gender and Vulnerable People	342
Table 97: Impacts and Significance – Community Health and Safety.....	346
Table 98: Residual Impacts – Community Health and Safety	349
Table 99: Monitoring – Community Health and Safety	350
Table 100: Impacts and Significance – Road Safety.....	355
Table 101: Residual Impacts – Road Safety	363
Table 102: Monitoring – Road Safety	364
Table 103: Impacts and Significance – Labour and Working Conditions	368
Table 104: Residual Impacts – Labour and Working Conditions.....	370
Table 105: Monitoring – Labour and Working Conditions.....	371
Table 107: Impacts and Significance – OHS	376
Table 108: Residual Impacts – OHS.....	379
Table 109: Monitoring – OHS.....	380
Table 106: Impacts and Significance – Waste Management and Spoil Disposal.....	385
Table 107: Residual Impacts – Waste Management and Spoil Material	389
Table 108: Monitoring – Waste Management and Spoil Material	390
Table 109: Impacts and Significance – Cultural Heritage	396
Table 110: Residual Impacts – Cultural Heritage.....	399
Table 111: Monitoring – Cultural Heritage.....	400
Table 112: Impacts and Significance – Community Infrastructure.....	405
Table 113: Residual Impacts – Community Infrastructure	411
Table 114: Monitoring – Community Infrastructure	412
Table 115: Summary of Stakeholder Engagement Activities Undertaken to Date	416
Table 116: Planned Stakeholder Engagement Activities	418
Table 117: Information Disclosure Schedule	421
Table 118: Summary of ESHS Implementation Responsibilities	433

List of Figures

Figure 1: Typical Road Section (approx. KM 2)	19
Figure 2: Typical Road Section (approx. KM 24)	20
Figure 3: Road Location	21
Figure 4: Typical Cross-sections.....	30
Figure 5: Road Pavement Structure – Type 1	36
Figure 6: Single Span Bridge Design, Bridge 1	37
Figure 7: Long Span Bridge Design, Bridge 4	38
Figure 8: Riverbed Protection	41
Figure 9: Groynes KM 9.0- 9.4	41
Figure 10: Example of Groyne, KM 18.6	41
Figure 11: Approximate Soil Disposal Locations	46
Figure 12: Wind Roses	108
Figure 13. Number of affected people by key natural hazard in Tajikistan for 1980-2020	109
Figure 14. Average annual natural hazard occurrence in Tajikistan for 1980-2020	109
Figure 15. Flood-prone areas throughout the project area.....	111
Figure 16. Landslide-prone areas throughout the project area	112
Figure 17. Rockfall-prone areas throughout the project area	114
Figure 18: Elevation range for the road project (from 926 to 1658 meters above sea level)	117
Figure 19: Valley Cross Section (road alignment in yellow).....	118

Figure 20: Key Hydrological Features in the Region	126
Figure 21: Monitoring Locations.....	129
Figure 22: Air Quality and Noise Monitoring Locations.....	133
Figure 23: Habitat Mapping, KM0-KM 5	137
Figure 24: Habitat Mapping, KM 5-KM 10	138
Figure 25: Habitat Mapping, KM 10-KM 15	139
Figure 26: Habitat Mapping, KM 15-KM 20	140
Figure 27: Habitat Mapping, KM 20-KM 25	141
Figure 29: Habitat Mapping, KM 30 -KM 35	143
Figure 29: Habitat Mapping, KM 35-KM 40	144
Figure 30: Habitat Mapping, KM 40-KM 45	145
Figure 31: Habitat Mapping, KM 45-KM 50	146
Figure 32: Habitat Mapping, KM 50-KM 56	147
Figure 28: The Shurkhob River looking south from Sari Khosor Natural Park (Source: Sari Khosor Natural Park documentation)	152
Figure 29: Map of Sari Khosor Natural Park boundary (Source: Sari Khosor Natural Park documentation). The road corridor is located to the south of the Park boundary.....	152
Figure 30: Nurek Reserve.....	155
Figure 31: Tributary gorge with early-spring riparian scrub (willow, poplar, shrub layer) within the project corridor, March 2026. These tributary confluences represent the most structurally intact natural vegetation along the alignment.....	158
Figure 32: (left): Close-up of Eremurus sp. or Juno/Iris sp. rosette on dry clay slope within the project corridor, March 2026. (right): Population of the same species on a hillside slope adjacent to the road edge	160
Figure 38: Mature Pyrus tadshikistanica (Critically Endangered) at km 29, growing at the edge of the existing alignment.....	162
Figure 39: Veteran ("old tree") Pyrus tadshikistanica (CR) at Chilton, km 34 (left side of track), growing against the rock outcrop where the existing track passes immediately beside its canopy and root zone.....	163
Figure 33: Vulture group observed during March 2026 field survey within the project corridor. The observation of four raptor species at one location indicates the presence of stable trophic interactions within the valley ecosystem.....	170
Figure 41: Cliff-nesting raptor habitat in the upper corridor (vicinity of km 36) — limestone crags providing nesting sites for Egyptian and Cinereous Vulture.....	171
Figure 42: Egyptian Vulture (Neophron percnopterus) at a cliff-cavity nest at km 2, within the works footprint — one of two confirmed active nests in the km 2–4 works zone.	172
Figure 34: Birds	172
Figure 40: Mammals	174
Figure 36: Settlements in the Project Corridor.....	178
Figure 37: Settlement, KM 24.....	179
Figure 38: Settlement, KM 28.....	179
Figure 39: Road Condition – Approximately KM 5.....	184
Figure 40: Road Passing through River Bed	185
Figure 41: Sari Khosor Hotel	192
Figure 42: Possible archaeological receptor (stone features within red circle) adjacent to proposed Project alignment (red line) in Sari Khosar	197
Figure 43: Ajinatepa Buddhist Monastery: view to the south-east.....	198
Figure 44: Kal'ai Baljuvon Fortress (red box) location relative to the proposed Project alignment (red line) in Baldzhuvon	199
Figure 45: Mosque structure (circled in red) in community east of Sari Khosar and located approximately 170 m north of the proposed Project alignment (red line)	200
Figure 46: Predicted Noise Levels.....	271
Figure 56: Confirmed Pyrus tadshikistanica at km 29 (38°30'45.4"N, 69°48'51.6"E, near Shahidon), immediately beside the existing alignment (yellow).....	306
Figure 57: Confirmed Pyrus tadshikistanica at km 34 (design station approx. Пк 336–337). Upper: position relative to the existing alignment (yellow), on the downslope/river side. Lower: position (red marker) on the detailed design — the road earthworks cut into the slope on the north side of the alignment, leaving the tree just outside the construction zone but in close proximity, requiring protection during works. (Figure number to be assigned on insertion.).....	307



Figure 58: Km 2 Egyptian / Cinereous Vulture nest relative to the BSK alignment. The nest lies ≈ 145 m from the alignment at the closest approach; the alignment passes within the 250 m breeding-season no-works exclusion buffer (red reach, ≈ 280 m). Alignment from BSK_New (June 2026); nest location from the PT4/EV survey waypoint. Schematic plan, local metric grid (100 m). 309

Acronyms

Acronym	Meaning
ADB	Asian Development Bank
AOI	Area of Influence
AQDMP	Air Quality and Dust Management Plan
BMP	Biodiversity Management Plan
BOD	Biological Oxygen Demand
BSK	Baljuvon – Sari Khosor
CAREC	Central Asia Regional Economic Cooperation
CBD	Convention on Biological Diversity (UN)
CEDAW	Convention on the Elimination of All Forms of Discrimination Against Women
CEP	Committee for Environmental Protection of the Republic of Tajikistan
CESMP	Contractor's Environmental and Social Management Plan
CH	Critical Habitat
CHA	Climate Hazard Assessment
CHMP	Cultural Heritage Management Plan
CHS	Community Health and Safety
CHSEP	Cultural Heritage Stakeholder Engagement Plan
CLO	Community Liaison Officer
COD	Chemical Oxygen Demand
COI	Construction Corridor of Influence
CRA	Climate Risk and Adaptation Assessment
CRC	Convention on the Rights of the Child
CSC	Construction Supervision Consultant
DITI	Design Institute of Tajikistan Infrastructure
E&S	Environmental and Social
EAAA	Extended Area of Anthropogenic Activity
EBRD	European Bank for Reconstruction and Development

Acronym	Meaning
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
ESAP	Environmental and Social Action Plan
ESIA	Environmental and Social Impact Assessment
ESHS	Environmental, Social, Health and Safety
ESM	Environmental and Social Manager
ESMP	Environmental and Social Management Plan
ESR	Environmental and Social Requirement (EBRD)
ESP	Environmental and Social Policy (EBRD)
EU	European Union
GBV	Gender-Based Violence
GBIF	Global Biodiversity Information Facility
GIIP	Good International Industry Practice
GPS	Global Positioning System
GRC	Grievance Review Committee
GRM	Grievance Redress Mechanism
IAQM	Institute of Air Quality Management
IBAT	Integrated Biodiversity Assessment Tool
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IFI	International Financial Institution
IUCN	International Union for Conservation of Nature
LMP	Labour Management Procedures
MAE	Maximum Allowable Emission
MPC	Maximum Permissible Concentrations
NCR	Non-Conformance Report
NMAT	National Museum of Antiquities of Tajikistan

Acronym	Meaning
NTS	Non-Technical Summary
NVMP	Noise and Vibration Management Plan
ODK	Open Data Kit
OHS	Occupational Health and Safety
PCM	Project Complaint Mechanism (EBRD)
PIURR	Project Implementation Unit for Roads Rehabilitation
PMB	Polymer Modified Bitumen
PPE	Personal Protective Equipment
PPV	Peak Particle Velocity
RAP	Resettlement Action Plan
RP	Resettlement Plan
RSA	Road Safety Audit
RSMP	Road Safety Management Plan
RSIA	Road Safety Impact Assessment
SCLO	Senior Community Liaison Officer
SEA/SH	Sexual Exploitation and Abuse / Sexual Harassment
SEE	State Ecological Expertise
SEP	Stakeholder Engagement Plan
SES	Sanitary and Epidemiological Service
TJS	Tajikistani Somoni
TMP	Traffic Management Plan
ToR	Terms of Reference
TPH	Total Petroleum Hydrocarbons
TSP	Total Suspended Particles
UNESCO	United Nations Educational, Scientific and Cultural Organization
WBG	World Bank Group



I. Introduction and Background

1.1. Background & Context

The European Bank for Reconstruction and Development (EBRD) is considering providing financing to the Republic of Tajikistan for the upgrade of the Baljuvon–Sari Khosor (BSK) road section. The PIURR under the Government of Tajikistan will act as the implementing agency. The Project involves upgrading approximately 56 km of an existing unpaved road to a two-lane Category V standard to enable year-round access, improve safety, and enhance connectivity between settlements and regional markets. The Project has been categorized as Category A under the EBRD Environmental and Social Policy (ESP) (2024), requiring a full ESIA and meaningful stakeholder engagement throughout the project lifecycle.

1.2. Project Components

Key components include rehabilitation of the existing alignment; construction of paved carriageway, shoulders, drainage structures, culverts, and bridges; slope stabilization and erosion protection in mountainous sections; installation of road safety features and signage; and establishment of temporary construction facilities such as camps, borrow areas, material stockpiles, and access roads. The Project also includes ancillary activities required for construction and operation, including traffic management, utility coordination, and environmental and social mitigation measures. These components will be implemented in a manner designed to maintain access for local communities and minimize disruption during construction.

1.3. Project Objectives

The Project's primary objective is to provide a safe, reliable, and year-round road connection between Baljuvon district and the Sari Khosor area, improving mobility for local communities and strengthening regional connectivity. The upgraded road is intended to enhance access to essential services such as healthcare, education, and markets; improve road safety and reduce travel times; support local economic development, including agriculture and tourism; and increase climate resilience of transport infrastructure in a mountainous and hazard-prone area. The Project also aims to align with national development priorities and international lender requirements by integrating environmental and social risk management, meaningful stakeholder engagement, and inclusive development principles throughout the project lifecycle.

1.4. Purpose and Objectives of the ESIA

The purpose of this ESIA is to identify, predict, and evaluate the potential environmental and social risks and impacts associated with the BSK Road Project, and to define measures to avoid, minimise, mitigate, and, where residual impacts remain, offset or compensate for adverse effects. The ESIA has been prepared in accordance with applicable national legislation of the Republic of Tajikistan, the EBRD ESP (2024) and applicable Environmental and Social Requirements (ESRs), and relevant EU substantive environmental standards.

The specific objectives of the ESIA are to:

1. Describe the Project in sufficient detail to enable a thorough understanding of its components, activities, schedule, and areas of influence;
2. Review and document the applicable policy, legal, and regulatory framework, including national legislation, EBRD ESP and ESRs, and relevant EU environmental standards;
3. Characterise the existing environmental and social baseline conditions within the Project's area of influence, drawing on available data and targeted field surveys;



4. Identify and assess potentially significant direct, indirect, cumulative, and induced environmental and social impacts across all relevant Project phases, including pre-construction, construction, operation, and decommissioning;
5. Screen for biodiversity sensitivities, including potential critical habitat features, and assess the implications for Project design and the mitigation hierarchy;
6. Assess social risks and impacts, including those related to land acquisition and resettlement, livelihoods, vulnerable groups, cultural heritage, gender, and road safety;
7. Define the mitigation hierarchy and propose a structured Environmental and Social Management Plan (ESMP) to address identified risks and impacts;
8. Identify potentially affected stakeholders and summarise the outcomes of meaningful stakeholder engagement conducted throughout the ESIA process; and
9. Support compliance with EBRD disclosure requirements and inform the preparation of associated environmental and social documentation.

The assessment is proportionate to the scale, location, and risk profile of the Project and integrates findings from the Scoping Study, supplemental baseline surveys, and stakeholder engagement undertaken throughout the ESIA process. Given the Project's Category A classification, the ESIA has been prepared to a standard consistent with EBRD requirements for projects with significant potential environmental and social impacts.

1.5. Links to other Documents

This ESIA forms part of a broader suite of environmental and social instruments prepared for the Project. It should be read in conjunction with the following associated documents:

1. **ESIA Scoping Report** – documents the scoping process undertaken prior to this ESIA, including the identification of key environmental and social risks, the scope of baseline studies required, and the approach to stakeholder engagement;
2. **Environmental and Social Management Plan (ESMP)** – sets out the measures, responsibilities, monitoring requirements, and institutional arrangements for managing environmental and social risks and impacts throughout the construction and operation phases – includes detailed framework topic and site specific plans to be adopted by the Contractor as part of his CESMP;
3. **Stakeholder Engagement Plan (SEP)** – describes the approach to identifying and engaging stakeholders and affected communities throughout the Project lifecycle, including vulnerable and under-represented groups;
4. **Biodiversity Management Plan (BMP)** – provides biodiversity mitigation measures, monitoring requirements, and management actions to be implemented by the Contractor (included as a sub-plan of the ESMP);
5. **Resettlement Plan (RP)** – addresses land acquisition, compensation, and livelihood restoration for Project-affected persons in accordance with applicable national requirements and EBRD ESR5;
6. **Labor Management Procedures (LMP)** – defines the approach to managing labour risks and working conditions in accordance with EBRD ESR2 (included as a sub-plan of the ESMP); and
7. **7. Non-Technical Summary (NTS)** – provides a concise, standalone summary of the ESIA findings in plain language accessible to the general public. The NTS will be translated into Tajik and Russian and disclosed together with the ESIA for a minimum of 120 days prior to EBRD Board consideration, in accordance with EBRD Category A disclosure requirements.



In the event of any inconsistency between these instruments, the more stringent requirement shall apply, with priority given to applicable national legislation and EBRD Environmental and Social Requirements (ESRs).

1.6. Structure of the ESIA

The report is organised as follows:

- **Section 1 – Introduction and Background:** Provides an overview of the Project, its objectives, the purpose of the ESIA, and links to associated environmental and social instruments.
- **Section 2 – Project Description:** Describes the Project location and regional context, key components, Project phases, and associated facilities.
- **Section 3 – Policy, Legal and Administrative Framework:** Identifies applicable national environmental and social legislation, EIA requirements, EBRD ESP (2024) and applicable ESRs, and relevant EU substantive environmental standards.
- **Section 4 – Analysis of Alternatives:** Summarises the main alternatives considered, including the "without Project" scenario, and outlines their implications for the ESIA.
- **Section 5 – Methodology:** Describes the approach and methods used in preparing this ESIA, including the scoping process, impact assessment methodology, desktop review, stakeholder engagement, and site visits.
- **Section 6 – Baseline Conditions:** Describes the existing environmental and social baseline conditions across the physical, biological, and socio-economic environment within the Project's area of influence.
- **Section 7 – Impact Assessment and Mitigation and Management Measures:** Assesses the significance of potential environmental and social impacts and defines the mitigation hierarchy and management measures required to avoid, minimise, mitigate, and offset adverse effects.
- **Section 8 – Stakeholder Engagement:** Summarises the stakeholder engagement undertaken throughout the ESIA process and outlines the approach to continued engagement.
- **Section 9 – ESIA Implementation:** Describes the institutional arrangements, responsibilities, monitoring requirements, and implementation arrangements for the ESMP.
- **Section 10 – Conclusions and Recommendations:** Presents the key findings of the ESIA and identifies any outstanding issues or recommendations.

2. Project Description

2.1. Overview

This section describes the Project, including its location and regional context, the condition of the existing road, the key components and technical parameters of the proposed works, the phases of implementation, and the associated facilities required to support construction. Together these elements define the Project as assessed in this ESIA and establish the basis for the impact assessment presented in Section 8.

2.1.1. Location and Regional Context

The BSK Project is located in Baljuvon District, within Khatlon Region of the Republic of Tajikistan. The Project involves the upgrade of an existing unpaved road linking the town of Baljuvon with the Sari Khosor area, extending generally in a north-easterly direction through mountainous terrain.

The road section begins at approximately km 28 of the Kangurt–Baljuvon road, which was previously rehabilitated with financial support from the Asian Development Bank (ADB), and continues towards the Sari Khosor waterfall area, which is recognised as an emerging tourism destination in the region. The total length of the road section is approximately 56 km. The road generally follows the Shurobdaryo valley and traverses steep mountainous terrain characterised by unstable slopes and exposure to natural hazards such as landslides, mudflows, erosion, and seasonal flooding. These hazards frequently damage sections of the road and can result in temporary closures, particularly during winter months and periods of intense rainfall. Figure 1 & 2 show a typical section of the existing road near km 2. Figure 3 provides an overview of the project location and alignment.

Figure 1: Typical Road Section (approx. KM 2)



Source: ESIA Team, January 2026

Figure 2: Typical Road Section (approx. KM 24)



Source: ESIA Team, March 2026

Figure 3: Road Location



Source: PIURR / Vista Environment



Approximately 19 settlements are located along or in close proximity to the road corridor, ranging from small rural communities to larger village centres. A wider population of approximately 30,000 people lives in the Baljuvon district area surrounding the corridor. While the alignment generally bypasses settlement cores, certain sections pass close to or through settlements, notably in the vicinity of Shahidon (around km 31) and Mullokoni (around km 53), where particular attention to access, safety, and community impacts will be required during design and construction.

Livelihoods along the corridor are predominantly agricultural. Due to the absence of reliable road access to markets in Kulyab, Bokhtar, and Dushanbe, much of the agricultural produce generated in the corridor is currently consumed locally or cannot be brought to market, constraining household incomes. The road's current condition creates effective seasonal isolation for communities along the upper sections of the corridor, which are inaccessible by conventional vehicles during winter months and periods of heavy rainfall. This isolation limits access not only to markets but also to health facilities, administrative services, and educational opportunities — a pattern that the Project directly aims to address.

2.1.2. Strategic Role in National and Regional Transport Network

Road infrastructure plays a uniquely dominant role in Tajikistan's national transport system. Approximately 95% of freight in the republic is transported by road, with limited alternatives provided by rail or air. Of the country's public road network, approximately 85% runs through mountainous terrain at altitudes above 500 m above sea level, making road maintenance and reliability particularly challenging. In this context, the reliability of individual mountain roads carries outsized economic and social significance.

The BSK road occupies a strategically important position within this network. It provides the primary — and in many places the only — overland connection between the Baljuvon district and the wider regional and national road system, linking the district to Bokhtar (the regional centre of Khatlon Province), Dushanbe, and other regions of the country. The road is part of the broader Central Asian Regional Economic Cooperation (CAREC) corridor system, which is oriented towards improving regional trade and transport integration across Central Asia.

In the longer term, the BSK road is planned to form part of a continuous link northward to the Nurobod–Tavildara–Kalaihum road (RB02, formerly M41), which forms part of the Pamir Highway — a route of international significance connecting Tajikistan to the Kyrgyz Republic and the wider CAREC road network. This future connection significantly elevates the strategic importance of the BSK road beyond local access, positioning it as a contributing element of an international transport corridor.

2.1.3. Key Components of the Project

The Project involves the rehabilitation and upgrade of an existing unpaved road between Baljuvon and the Sari Khosor area to provide a safe and reliable year-round transport connection. The Project will be implemented largely along the existing alignment, with localised realignments and widening where required to meet technical, safety, and resilience requirements.

The key components of the Project include:

- Road rehabilitation and upgrading, comprising earthworks, formation of engineered pavement layers, and construction of a paved carriageway suitable for two-lane operation in accordance with applicable road design standards;
- Road widening and geometric improvements at selected locations to improve safety, accommodate design speeds appropriate to mountainous terrain, and address constraints related to steep slopes and limited sight distances;
- Drainage infrastructure, including the rehabilitation or construction of culverts, cross-drainage structures, side drains, and erosion protection measures to manage surface water, reduce flood risk, and improve climate resilience;



- Bridge and watercourse crossings, including rehabilitation or replacement of existing structures where required to improve hydraulic performance and structural safety;
- Slope stabilisation and protection works, particularly in areas exposed to landslides, rockfall, and erosion;
- Road safety measures, including signage, markings, barriers, and local traffic management features, particularly in the vicinity of settlements and community infrastructure.

In addition to the permanent road works, the Project will require a range of temporary and ancillary facilities and activities during construction, which are considered associated facilities for the purposes of the ESIA.

The Project will be implemented in a manner intended to maintain access for local communities during construction to the extent practicable, recognising the importance of the road for daily movement, access to services, and livelihoods along the corridor

2.2. Existing General Features

The existing BSK road is an unsurfaced earth and gravel track, passable only by four-wheel drive vehicles. Road width varies between approximately 3.7 m and 7 m. The road was originally constructed in the 1960s. The Ministry of Transport undertakes periodic maintenance efforts, but limited funding restricts these to rudimentary activities that do not achieve acceptable traffic conditions or road safety standards.

The functional performance of the road reflects its physical condition. Current traffic intensity is low, with approximately 10 to 20 vehicles per day recorded along the corridor, though annual traffic growth is estimated at approximately 10% as the district develops. Travel times are highly constrained by alignment geometry and surface conditions: the 31.2 km distance from Baljuvon to Shahidon — the largest village along the corridor — currently requires more than two hours by four-wheel drive vehicle. Horizontal geometry is severely substandard in places, with minimum curve radii below 20 m recorded in some sections and maximum longitudinal gradients exceeding 12–15% in others. From approximately km 36 to km 56, no formal road surface exists and vehicles navigate the Shurobdaryobed on temporary tracks that are regularly washed out during rainfall events. The Project geotechnical survey (Geotechnical Report, Kocks, 2023) confirmed that the entire road corridor sits within an 8-point seismic zone (Category II soils under Tajik standards), which constrains slope and embankment design standards and increases the susceptibility of already unstable slopes to failure during seismic events. These conditions represent not merely poor road quality but functional failure of the infrastructure as a permanent transport connection.

The existing road starts from the junction with the Dangara–Kangurt–Khovaling road (RD-026 / republican road) near the bridge over the Shurobdaryo and continues toward the Sari Khosor area. From km 0 to km 8, some artificial drainage structures exist, including pipe culverts (1.0 m and 1.5 m diameter) and rectangular box culverts of various sizes (1.0×1.0 m to 2.5×2.5 m). Beyond km 8, drainage infrastructure is largely absent. There is no surface water control along the road and runoff erodes the road surface and embankment. Some limited concrete lining protection is present along sections adjacent to the Shurobdaryo. Sections along unstable slopes are unprotected.

2.2.1. Drainage and Hydraulic and Geotechnical Conditions

The existing drainage infrastructure is inadequate across the entire corridor. Culverts where present are undersized, blocked, and lack outlet protection, leading to extensive outlet erosion and embankment damage. The road lacks longitudinal drainage and there is no surface runoff control, with slopes frequently directing water directly onto the road surface.

Large sections of the alignment run along or within the floodplain of the Shurobdaryo. The river has a tendency to expand its flow channel towards the right bank, where the road is located, causing periodic erosion of the road embankment during high-flow events. The current road lacks

embankment protection against fast-flowing water in the riverbed, and no spur or groynes structures are in place. Existing slope protection consists only of limited sections of concrete lining.

Engineering-geological surveys carried out in 2023 identified and mapped 53 discrete sites of active hazardous geological processes along the corridor, including slope erosion, rockfall, landslides, mudflows, and riverbank scour. These are distributed throughout the full length of the route, with river bank erosion zones requiring protection works concentrated between approximately km 3 and km 52, active and ancient landslide areas at multiple locations (including confirmed zones at km 31–36, km 45–48, and km 86–89), and debris flow channels requiring retention structures at regular intervals.

The soils composing the corridor include weakly cemented siltstones and sandstones on clay cement, which rapidly lose strength when saturated, and dense loams with gravel inclusions — all of which are susceptible to erosion and slope failure under the rainfall and seismic conditions of the corridor. Groundwater was encountered at depths of only 2.5 to 3.0 m in floodplain sections, indicating that road platform stability in these areas will be sensitive to seasonal fluctuations in river and groundwater levels.

Hydrological surveys confirmed that peak discharges along the corridor occur in April and May and are predominantly of rainfall origin. Due to the easily erodible soils and bedrock along the valley slopes, intense rainfall events cause flows to acquire mudflow character, carrying significant solid material loads in addition to liquid runoff — a design condition that substantially increases the hydraulic and structural loading requirements for culverts, bridges, and bank protection works compared with equivalent flows on less erodible catchments. No hydrological gauging stations exist within the study area; design discharges were therefore derived using regional formulae calibrated to the territory of Tajikistan. For the Shurobdaryo itself, a design discharge of approximately 480 m³/s was calculated for the 2% exceedance return period, with debris flow rates at individual tributary crossings ranging up to approximately 127 m³/s at the most hydraulically active sites.

A design review carried out in late 2025 and early 2026 by a hydraulic and hydrological specialist confirmed these conditions and emphasised the need for a comprehensive and integrated drainage and protection system incorporating cross drainage, longitudinal drainage, outlet structures, and embankment protection against riverine scour.




Table 1: Summary of Geohazard Types and Distribution Along the BSK Corridor

Hazard Type	Locations (examples)	Evidence / Notes	General Mitigation Approach
Rock mass failure / rockfall	Widespread (e.g. km 6–14; sectors 1–6, 9, 11–13)	Very frequent along steep slopes; observed throughout corridor	Protective mesh, rock bolting, slope scaling, barrier embankments
Landslides (active / mobilised)	km 6–7; km 12–13; km 25–26; Sector 7 (critical zone)	Large active landslide cluster documented with GPS coordinates	Slope reprofiling, drainage, retaining structures
Mudflow / debris flow	km 7–8; km 25–32; multiple “sai” crossings	High-intensity rainfall-induced flows; catchment-driven processes	Retention basins, debris barriers, widened crossings
Riverbank erosion / scouring	km 3–7; km 9–11; km 13–24; km 30+	Extensive along Shurobdaryo corridor	Gabions, riprap, bank stabilisation





Flooding (river & lateral valleys)	km 7–8; km 11; km 12–14	Flood-prone zones mapped along alignment	Raised embankments, hydraulic capacity increase
Swampy / weak ground	Localised sections (limited occurrences)	Soft soils and drainage issues	Drainage and soil improvement

Source: Geotechnical Report – International Expert, July 2023.

Table 2: Geohazard Field Observations and Photo Log

Chainage	Location / Section	Key Observation	Interpreted Hazard Type	photos
KM1.6	Mid-section	Road along slope	Potential slope instability	
KM3.1 – 3.6	Landslide area	Large landslide zone affecting alignment	Active landslide	
KM4.1 – 4.2	Riverbank section	Erosion along riverbank	Bank erosion / scouring	

Chainage	Location / Section	Key Observation	Interpreted Hazard Type	photos
KM4.7	Localised section	Lateral scour and failed structure	Scour / hydraulic erosion	
KM5.2 – 5.9	River floodplain	Water along road in floodplain gravels	Flooding / river interaction	
KM 8.6 – 8.8	Same location	Additional view of landslide	Relict landslide	
KM 8.9 – 9.1	Alignment axis	Soil subsidence along route	Ground instability / settlement	

Chainage	Location / Section	Key Observation	Interpreted Hazard Type	photos
KM 11.6	Sai crossing	Mudflow channel crossing	Mudflow / debris flow	
KM 11.7 – 12.0	Geological section	Siltstones, clayey sandstones	Weak geology / erosion-prone	
KM18.7 – 21.4	Floodplain section	Road follows river floodplain	Flooding / erosion risk	
KM30.4 – 30.6	Bulgori channel	Active debris flow channel	Major debris flow corridor	

2.3. Scope of Works

2.3.1. General Design Approach

The design of the BSK road aims to rehabilitate and upgrade the existing alignment to provide a permanent asphalt road of Technical Category V standard, while using the existing road corridor as far as practicable and introducing local realignments, widening, protective works, and new structures where necessary to improve safety, drainage, and resilience. The design parameters reflect the



challenging topography of the corridor, the presence of natural hazards, and the need to improve drainage, slope stability, and road safety.

The route has been divided into two sections to facilitate design and implementation: Section 1 from km 0+000 to km 20+100, and Section 2 from km 20+100 to km 56+300. The design for both sections incorporates earthworks, pavement construction, drainage, culverts, bridges, retaining structures, road safety features, and extensive riverbank and shore protection works.

The road is designed as a two-lane Category V mountain road with a 6.0 m carriageway, 8.0 m subgrade width, and 1.0 m shoulders. Design speed is 30–60 km/h, with the alignment and longitudinal profile developed to reflect hilly and mountainous terrain constraints. The maximum longitudinal gradient is reported as up to 90‰ in some sections, and the minimum radius in plan is reported as 40 m in the general design tables, with smaller radii noted in difficult local sections.

In populated areas, the design includes additional local features such as sidewalks, lighting, curbstones, reinforced roadside edges, and drainage gutters. In certain constrained settlement sections and for some bridge-related elements, the design documentation refers to local application or checking of parameters associated with higher standards.

2.3.2. Key Technical Parameters

The principal road design parameters described in the updated design documentation include:

- Road technical category: Category V
- Total length: approximately 56.3 km
- Section 1 length: 20.1 km
- Section 2 length: 36.2 km
- Number of lanes: 2
- Carriageway width: 6.0 m
- Shoulder width: 1.0 m
- Subgrade width: 8.0 m
- Carriageway crossfall: 20‰
- Shoulder crossfall: 40‰
- Pavement type: asphalt concrete.

The design also specifies transverse and longitudinal drainage along the route, embankment slopes generally of 1:1.5, and excavation slopes varying by material and terrain conditions. In deeper cuts and more difficult conditions, berms and unloading benches are included to improve slope stability and facilitate construction. A widened berm of up to 3 m is also referenced in the cross-section design discussion.

2.3.3. Pavement, Earthworks and Road Formation

The road pavement structure has been designed for the local road climate and terrain conditions using Tajik and regional design guidance referenced in the design report. The finished surface will be asphalt concrete. The wearing course asphalt specification requires the use of polymer-modified bitumen (PMB) in place of conventional bitumen, to improve performance under elevated temperatures. This specification reflects the findings of the Climate Risk and Adaptation Assessment (CRA) regarding projected increases in extreme heat conditions and is consistent with current road design practice in Tajikistan. The design identifies two pavement structure types for different sections or conditions along the route.



Substantial earthworks will be required to widen and stabilise the road platform. Specific volumes are included in Table 4. The design indicates that a significant proportion of excavated material will be rock or hard material requiring drilling and blasting. Earthworks are to include cut-and-fill operations, preparation of the subgrade, benching on slopes where required, compaction of fill in layers, and protection of embankments and cut slopes. The design also notes that excess soil should be transported to designated disposal areas in accordance with environmental protection requirements.

Slope benching is incorporated into the design as a targeted measure at sections with steep gradients and elevated susceptibility to rainfall-induced instability. By introducing a series of stepped terraces along cut slopes, benching reduces the effective slope angle, interrupts surface runoff pathways, and limits the build-up of pore water pressure during intense precipitation events. This approach is consistent with the findings of the climate risk assessment, which identifies increased rainfall intensity as a key driver of slope instability along the corridor, including in higher-risk sections such as the km 3–8 reach. The design and construction requirements for slope protection and erosion control measures, including benching, are defined in Technical Specification Section 2400 (Slope Protection and Erosion Control), with associated earthworks incorporated into the Project's cost estimates. These measures form part of the integrated slope stabilisation approach described further in Section 2.3.5.

Because the project is located in mountainous terrain and follows the Shurobdaryo valley for long distances, earthworks and spoil management will have important environmental and social implications, particularly in relation to erosion, slope stability, sediment transport, drainage, community safety, and the location of spoil disposal areas.

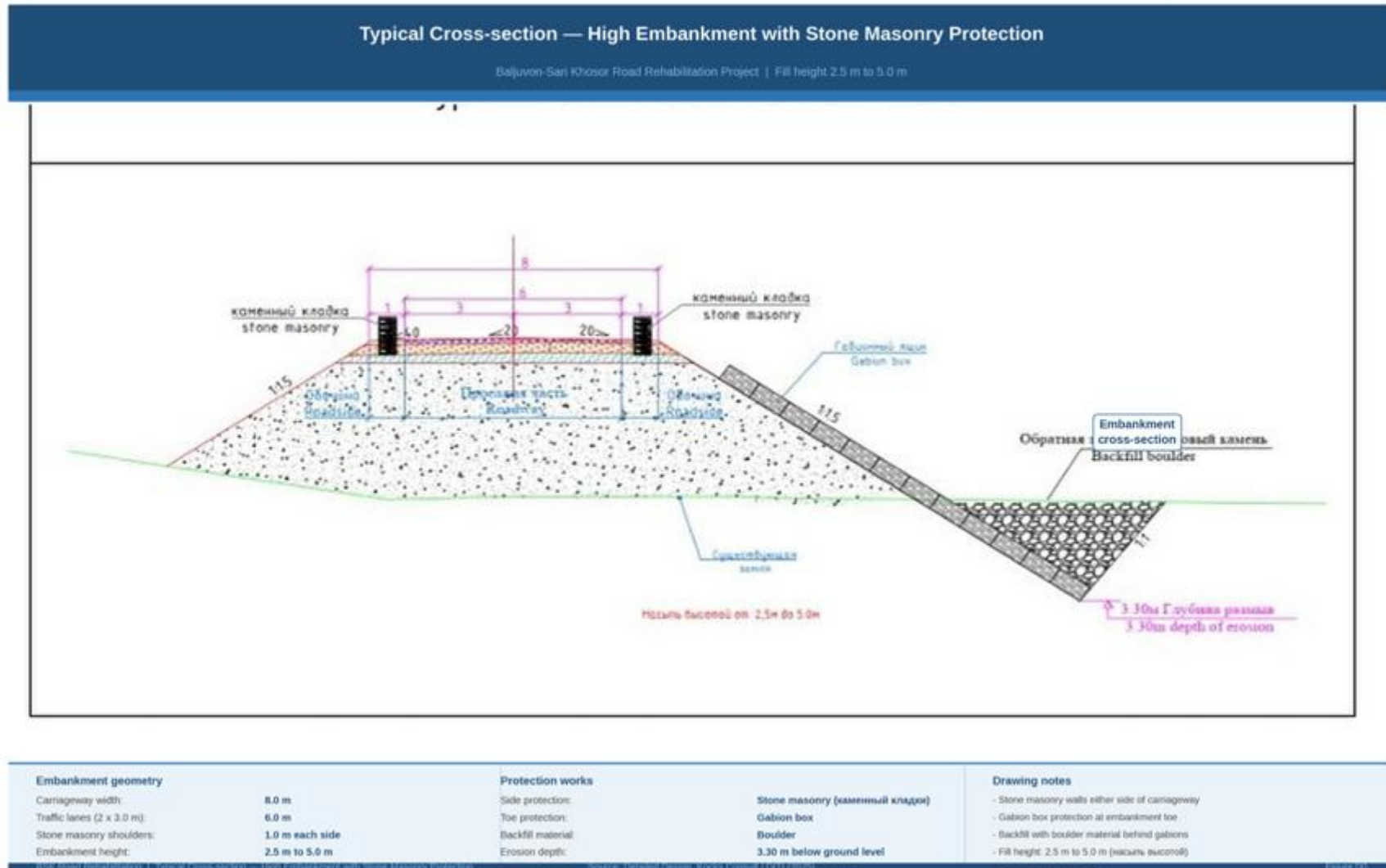
Road Width and Cross Section

The upgraded road will consist of a paved carriageway designed for two-lane operation with shoulders and drainage infrastructure. Typical cross-section elements include:

- Two traffic lanes;
- Road shoulders to provide lateral support and allow for emergency stopping;
- Side drainage ditches where required to manage runoff from adjacent slopes;
- Embankment protection and erosion control measures along sections located near the Shurobdaryo.

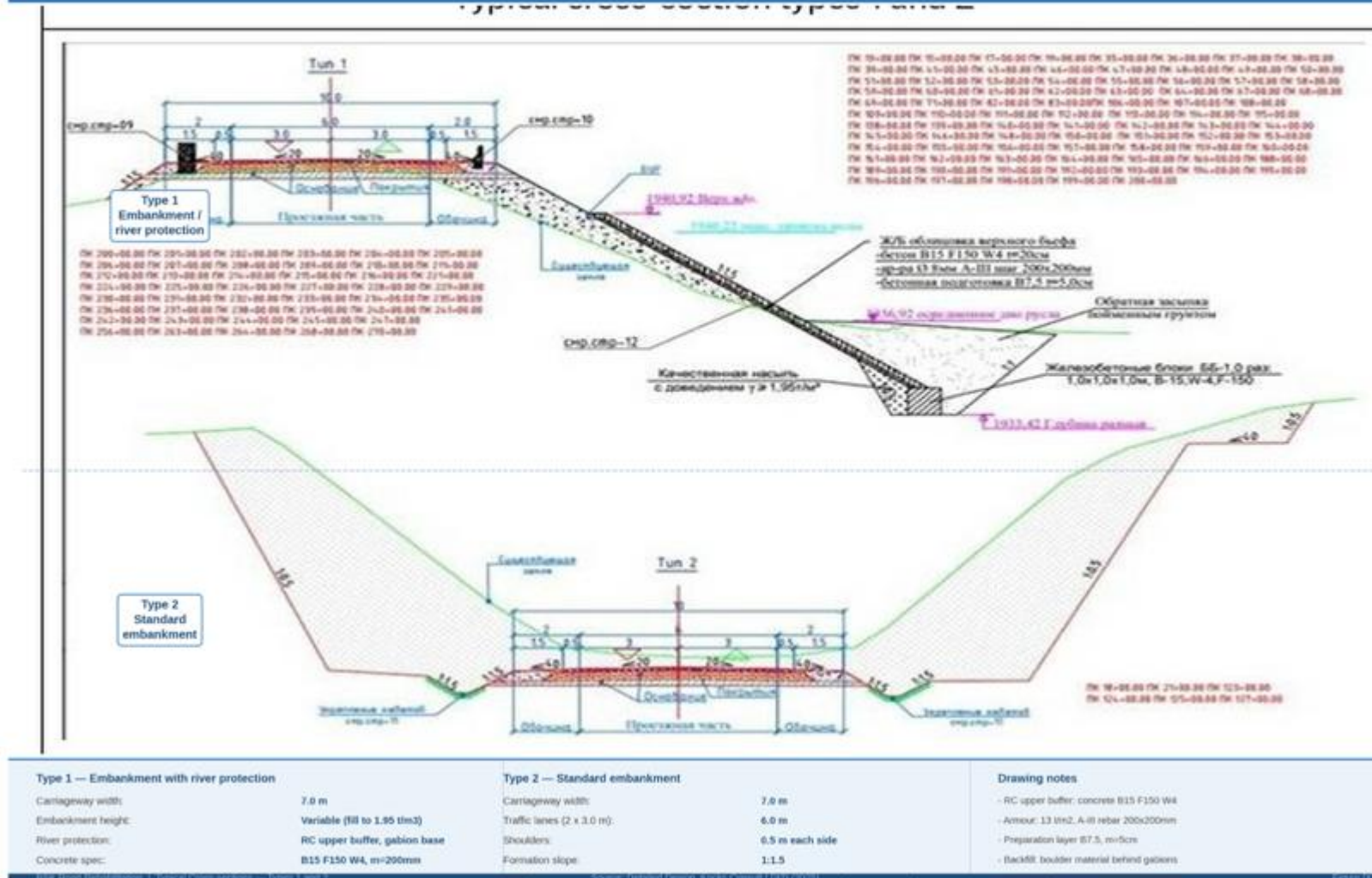
The design incorporates widening and geometric improvements at selected locations to improve sight distances and accommodate safe vehicle movement along steep mountain sections. Where the terrain is constrained by slopes or riverbanks, retaining structures and slope stabilisation works may be required to support the road platform.

Figure 4: Typical Cross-sections



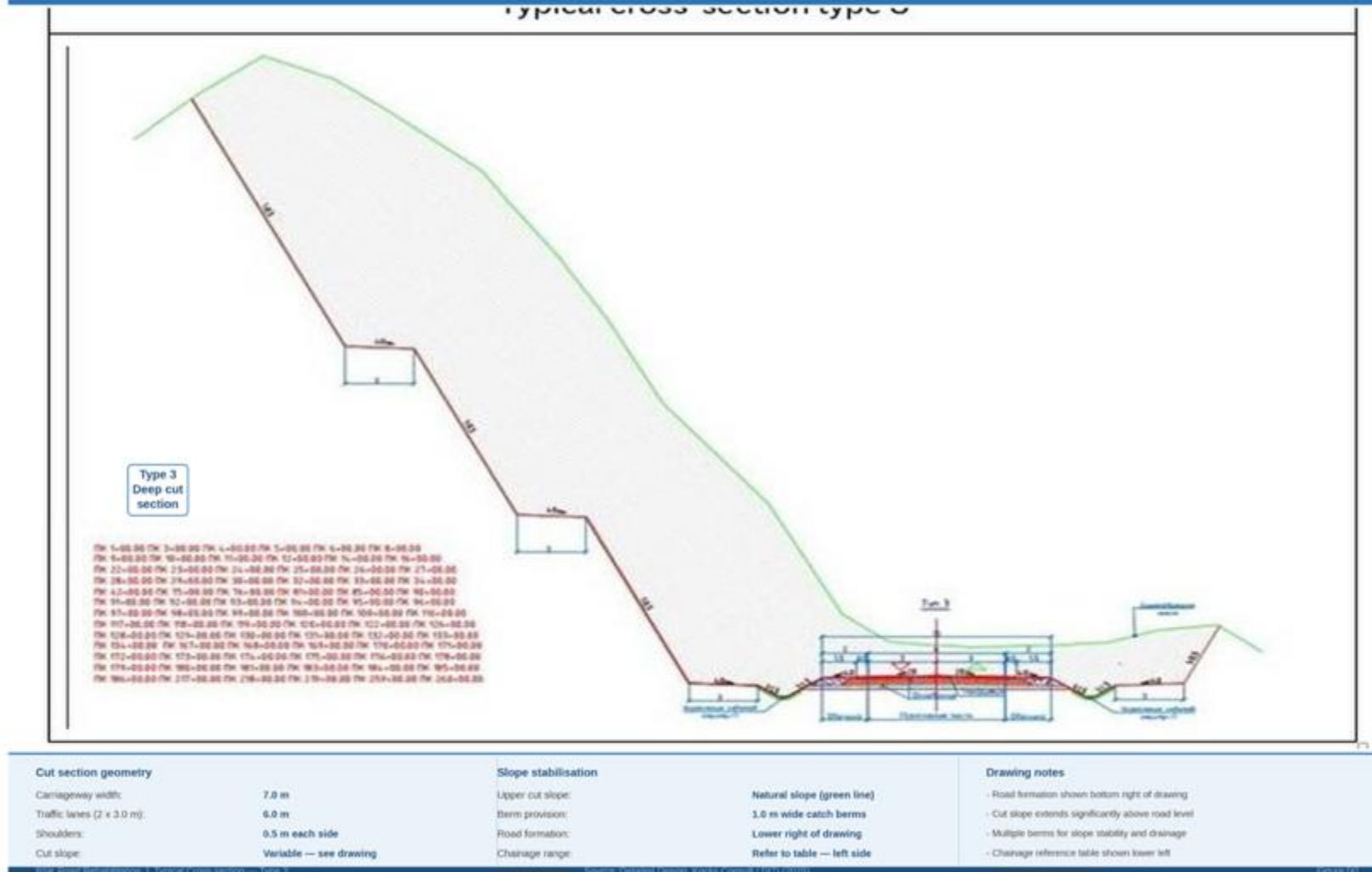
Typical Cross-sections — Types 1 and 2

Baljuvon-Sari Khosor Road Rehabilitation Project | Embankment and river protection sections



Typical Cross-section — Type 3

Baljuvon-Sari Khosor Road Rehabilitation Project | Deep cut section with slope stabilisation

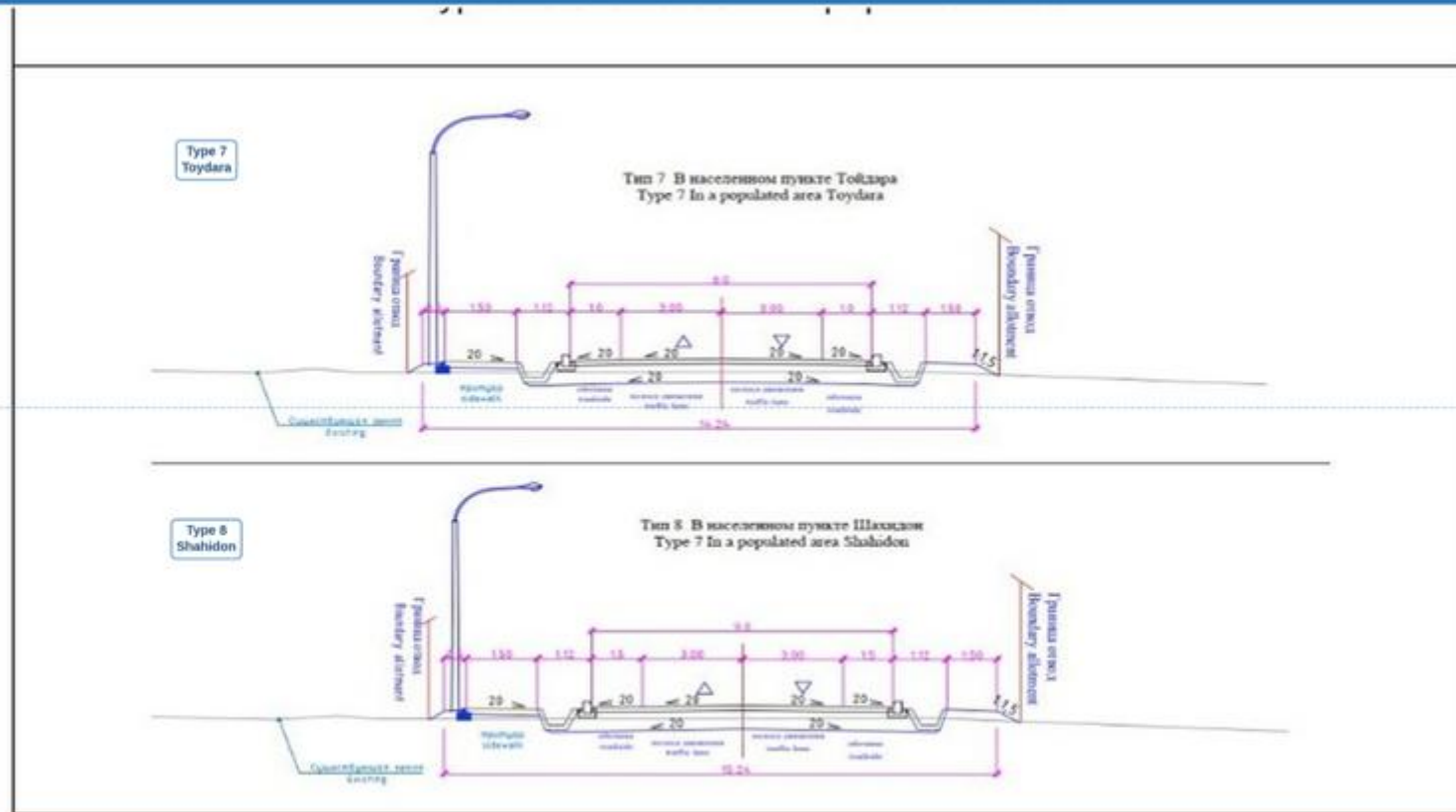






Typical Cross-sections in Populated Areas

Baljuvon-Sari Khosor Road Rehabilitation Project | Cross-section Types 7 and 8



Type 7 - Toydara		Type 8 - Shahidon		Drawing notes
Total carriageway width:	6.0 m	Total carriageway width:	9.0 m	
Traffic lanes (2 x 3.0 m):	6.0 m	Traffic lanes (2 x 3.0 m):	6.0 m	
Footway / sidewalk:	1.5 m each side	Footway / sidewalk:	1.5 m each side	
Roadside clearance:	1.12 m each side	Roadside clearance:	1.12-1.5 m	

- Existing road formation shown dashed (blue)
- All dimensions in metres unless otherwise stated
- Boundary allowance shown either side of formation
- Pavement design, refer to pavement cross-section drawing

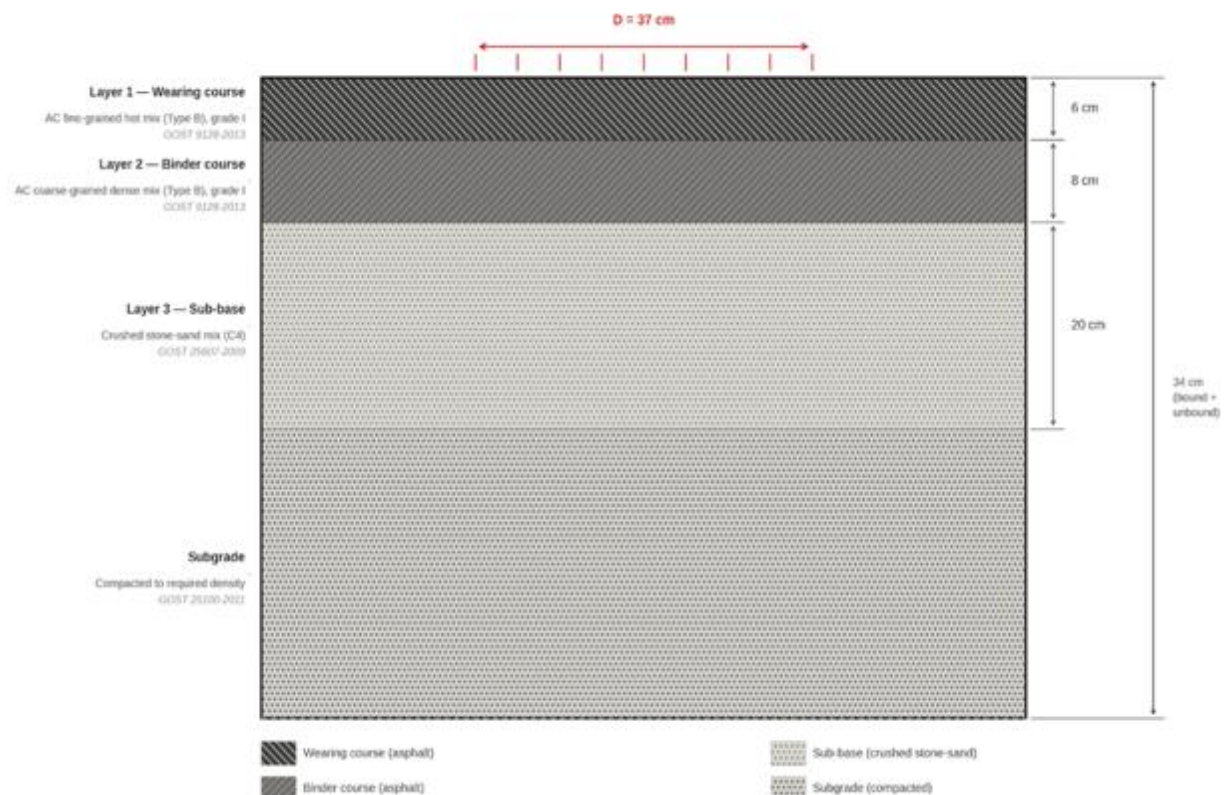
Pavement Structure

The pavement structure is designed to withstand seasonal climatic conditions, including freeze-thaw cycles, heavy rainfall events, and sediment transport from adjacent slopes. The pavement structure will typically consist of:

- Asphalt surface course;
- Base and sub-base layers constructed from crushed aggregate materials;
- Compacted subgrade prepared from existing soil or imported materials.

Design specifications encourage the reuse of excavated materials and reclaimed pavement where feasible in embankments and base layers in order to reduce the need for new borrow areas and minimise construction waste. In addition, the contractor will be required to implement measures to reduce the carbon footprint of construction activities, including the potential use of recycled aggregates and warm-mix asphalt technologies.

Figure 5: Road Pavement Structure – Type 1



Source: PIURR, 2026

2.3.4. Culverts, Drainage, and Hydraulic Structures

A continuous drainage system is planned along the route to intercept runoff from slopes, convey water safely away from the carriageway, and reduce erosion of the road platform. The design provides for side ditches, trapezoidal drains, culverts, and channel structures, together with reinforced drainage ditches and concrete-lined drainage elements in certain sections.

There are 49 existing culverts along the route, many of which require extension, reconstruction, or replacement because they are too old, hydraulically inadequate, or otherwise defective. In addition, 37 new culverts are planned, while some other existing culverts are to be cleaned and retained. The



design includes both round and rectangular reinforced concrete culverts of various sizes, with openings ranging from approximately 1.0 m diameter round pipes to larger box-type structures of up to 5.0 m by 2.5 m in some locations.

The detailed culvert schedules identify a large number of individual structures in both sections, reflecting the highly dissected terrain and the need to manage both watercourses and local drainage channels. Foundations are generally designed as concrete foundations on gravel bases, with alternative treatment proposed for subsiding soils. The design also provides for inlet and outlet protection and, where needed, fast-flow channels and other hydraulic control elements.

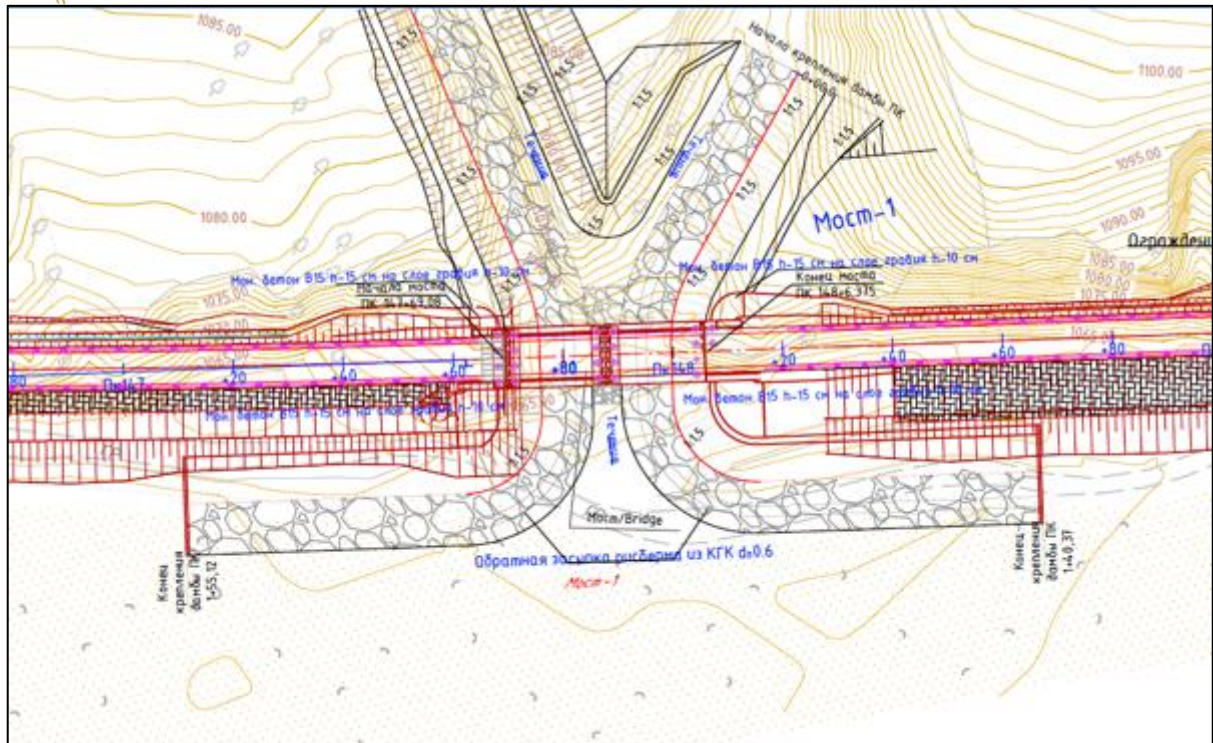
Given the project setting, the adequacy of culvert sizing, outlet protection, sediment control, and integration of cross-drainage with slope and embankment protection is critical to the environmental performance and climate resilience of the road. Accordingly, the hydraulic design adopts a conservative approach to reflect the high flood and debris flow risk along the corridor. Drainage structures are designed using a 100-year return period rainfall input of approximately 83 mm, based on data from the Khovaling and Kangurt meteorological stations, which exceeds the SNiP requirements for Category V roads (typically based on 33–50 year return periods). In addition, debris flow multipliers in the range of 2.6 to 4.8 have been applied to the design of drainage and cross-drainage structures to account for sediment-laden flows and high-energy events, supporting the climate resilience of the road infrastructure.

Bridges and Watercourse Crossings

The project includes a substantial number of artificial structures, including culverts, retaining walls, shore protection works, and bridges. The updated design identifies ten bridge structures along the overall route. Bridge lengths range from approximately 19 m to 137 m, with representative span arrangements including 1 × 18 m, 1 × 24 m, 3 × 33 m, 4 × 33 m, and 24 + 33 + 24 m configurations. Reported bridge widths are generally 11.0 m, with some wider local configurations.

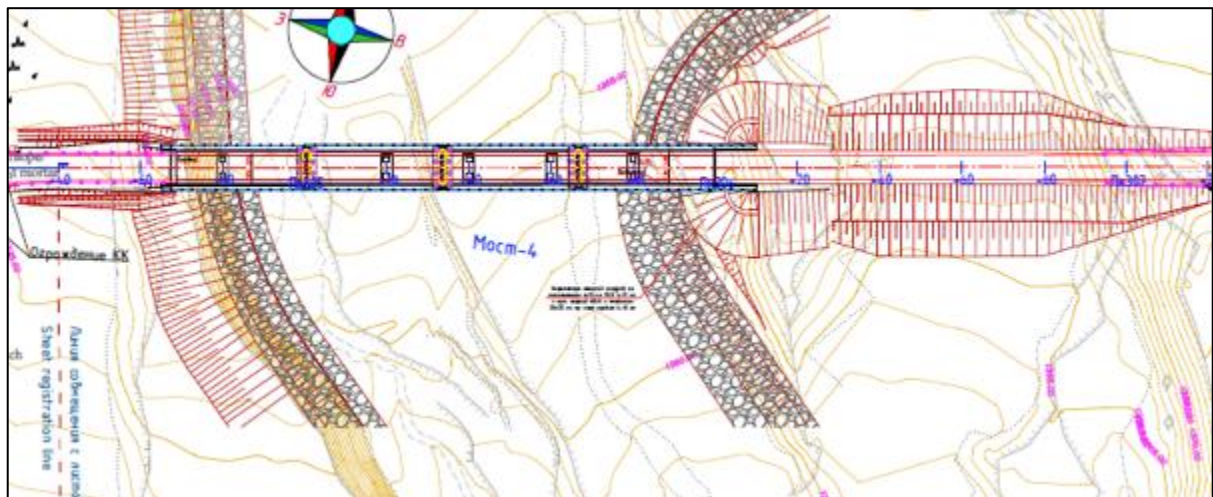
These structures will span seasonal streams and river channels that intersect the road corridor. The bridges are designed to accommodate flood flows and reduce the risk of washouts or road closures during extreme weather events. The bridge structures typically consist of reinforced concrete abutments and piers supporting steel or reinforced concrete superstructures. All bridge structures along the alignment are designed with piled foundations, which have been adopted as the standard foundation solution for the Project based on prevailing hydraulic and geotechnical conditions. The pile foundations are designed to address potential riverbed scour, lateral channel migration, and seismic loading, reflecting the dynamic river environment and seismic setting of the corridor. The foundation design is informed by geotechnical investigations undertaken in accordance with SNiP 11.02-96, including borehole drilling at each bridge crossing and at selected retaining wall locations. Final pile depths and configurations will be verified during construction based on site-specific ground conditions.

Figure 6: Single Span Bridge Design, Bridge 1



Source: PIURR, 2026

Figure 7: Long Span Bridge Design, Bridge 4



Source: PIURR, 2026

Table 3: List of Bridges Along the BSK Road

No. of Site	Site length, Km +	No. of structures	Location of the structure, PC	Nearest settlement	Name of obstacles	Parameters of designed bridges				Hydrological data				
						Bridge length, m	Bridge scheme, m	Bridge dimension, m	Bridge width, m	PTBB 1%	Q 2%	V max	H max	I
1	2		3	4	5	6	7	8	9	10	11	12	13	14
1	from 0 to 30	1	148+00.00	Khorma		19,2	1x18,0	8+2x1.0	10,9					
		2	270+25.00	Toidara		19,20	1x18,0	8+2x1.0	10,9		61,2			
		3	292+38.50	Toidara		19,20	1x18,0	10+2x1.0	12,9		63,5			
2	from 30 to 54.1	4	305+36.70	Shahidon	River Bulgorin	133,50	4x33.0	8+2x1.0	10,9		136,0			
		5	322+30.00	Shahidon		82,40	24+33+24	8+2x1.0	10,9		74,0			
		6	367+20.00	Nusai		19,20	1x18.0	8+2x1.0	10,9		75,0			
		7	430+80.00	Peshtova		82,40	24+33+24	8+2x1.0	10,9		238,0			
		8	456+30.00	Toghaev		82,40	24+33+25	8+2x1.0	11,9		203,0			
		9	488+00.00	Shikeldara	darai Gugird	82,40	24+33+26	8+2x1.0	12,9		98,0			
		10	518.+20.00	Mulokoni	hackowdara	19,2	1x18,0	8+2x1.0	10,9					

Source: PIURR, 2026

Culverts and Cross-Drainage

Cross-drainage structures are a critical component of the project due to the steep terrain and high runoff volumes generated during rainfall and snowmelt events. The upgraded road will include:

- Reinforced concrete or HDPE culverts at natural drainage crossings;
- Side drainage channels to collect runoff from adjacent slopes;
- Outlet protection structures to prevent erosion and sediment transport.

Existing culverts found to be undersized, blocked, or lacking outlet protection will be replaced or upgraded to provide improved hydraulic capacity. The hydraulic design review confirmed that all drainage structures must be designed with an adequate free flow section to allow for sediment transport, with a minimum freeboard of 1.5 m, increased to 2.0 m at debris flow crossing locations. A list of culverts are included as Annex A.

2.3.5. Retaining Walls, Shore Protection, and River Training Works

Large sections of the road run parallel to the Shurobdaryo, where riverbank erosion and flood events have historically caused repeated damage to the road embankment. The design includes a combination of longitudinal riverbank protection measures and transversal structures. Gabion mattresses and Reno mattresses will be installed along embankment slopes, with geotextile filters beneath all protection structures. Because much of the road runs parallel to the river or below steep slopes, the project includes extensive protection works to reduce erosion, stabilise the road platform, and protect bridge crossings and embankments. These works include retaining walls, gabion retaining structures, riverbank protection works, spurs, and local rock or concrete protection measures.

Galvanised steel mesh will be used throughout, with stone materials required to meet specified quality standards for hardness and low water absorption. Material performance specifications for gabion mesh, concrete mix designs, and riprap sizing have been defined to account for climate-amplified hydraulic and sediment loads, including increased abrasion, elevated temperatures, and thermal stress cycling over the design life of the Project.

Spurs (groynes) will be installed at locations where river flow tends to approach the road embankment, designed hydraulically to redirect the main river channel away from the road. The positions, lengths, and inclinations of all spurs have been reviewed by the hydraulic design review consultant.

In addition, river training and channel regulation works are defined as a formal component of the hydraulic protection system in sections of elevated erosion and flood risk, particularly within the km 0–5 reach (notably around km 4), where historical embankment instability and concentrated flow impingement have been observed. In these locations, spur dikes (groynes) function not only as local protection measures but as active hydraulic interventions that redirect high-velocity flows toward the centre of the channel, thereby reducing direct loading on the embankment and improving channel stability. The design standards, material specifications, and construction requirements for these structures are set out in Technical Specification Section 2100 (River Training and River Channel Regulation Works), with corresponding quantities included in BOQ Bill No. 3, confirming their integration into the Project's defined construction scope.

BANK REINFORCEMENT WORKS

MATERIAL SCHEDULE -- LEFT BANK SECTION

No.	Description	Spec / Dimension	Unit	Qty
1	Backfill excavation slope 1:1, slope 10, 42-50%	m ³	164.2	
2	Rock material type V-423	1 + 20 cm	m ³	1,047
3	CMSD grade 5-41mm	200x200mm geo	m ²	145
4	Concrete armor block	475, 140 x 140	m ³	231
5	Reinforced CMSD (secondary)	secondary unit	m ²	1,122
6	P115 buffer layer	...	m ²	305
7	Concrete armor block	unreinforced 40 x 100	m ³	1,242
8	Concrete armor block	40 x 100	m ³	2,376
9	Concrete armor block	...	m ³	1,095
10	Concrete armor block	40 x 100	m ³	188
11	Concrete armor block	...	m ³	188
12	Reinforcement A/D	...	m	12.4

MATERIAL SCHEDULE -- CHANNEL SECTION

No.	Description	Spec / Dimension	Unit	Qty
1	Concrete armor block (20-1.5 to 1.5-1.5) 40 x 100	geo	124	
2	Concrete armor block	...	448	
3	P115 buffer layer	1 + 10 cm	m ²	212
4	Concrete armor block	...	188	
5	Concrete armor block	40 x 100	m ³	124
6	Concrete armor block	40 x 100	m ³	24
7	Concrete armor block	...	424	
8	Concrete armor block	...	188	
9	Concrete armor block	...	188	
10	Concrete armor block	...	188	

For Section 1, the design identifies approximately 7,689 m of shore protection works and 15 spurs, together with a number of existing shore protection sections to be retained or considered. For Section 2, the design identifies approximately 12,795 m of shore protection works and 3 spurs. The design also refers to hazardous sections reinforced with concrete cubes and large stones to protect gabion mesh and riverbank structures in areas of high hydraulic stress.

Technical map of the railway line between Santhar and Santhar, showing the route, stations, and surrounding terrain. The map includes a compass rose, a scale bar, and various labels for stations and landmarks.

Figure 10: Example of Groyne, KM 18.6



Source: PIURR

Retaining walls are also planned at selected locations, including both reinforced concrete and gabion retaining wall types. The design schedule identifies several retaining wall sections, including a major gabion retaining wall section of approximately 720 m.

These structures are a critical component of the project because they directly influence river morphology, bank stability, sediment dynamics, flood behaviour, and the long-term resilience of the road. They will therefore be important both for project description and for later environmental assessment chapters dealing with hydrology, erosion, geomorphology, and aquatic habitats.

Slope Stabilisation and Natural Hazard Mitigation

The project corridor passes through mountainous terrain with widespread and varied natural hazard exposure. A natural hazard survey conducted in June 2023 by an international geotechnical expert identified approximately numerous hazard locations along the full alignment, catalogued across 14 sectors. The hazards identified fall into seven categories: rock mass failure and rockfall, landslides (including already-mobilised slides), mudflows, debris flows, riverbank erosion and scouring, flooding, and swampy ground conditions presenting soft foundation risks. Rock mass failure, erosion, and rockfall are the most frequently occurring hazard type and are present throughout the corridor. Landslides, including several already-mobilised failures, are concentrated in sectors 7 and 2, broadly corresponding to the km 25–32 and km 3–8 sections of the alignment. Debris flows have been identified at multiple tributary crossings, with catchment analysis confirming large source areas and evidence of frequent high-energy events. Swampy areas presenting soft foundation conditions for the road embankment have been identified in the sector 4–5 area (broadly km 15–20).

The design incorporates hazard mitigation measures proportionate to each hazard type. For rock mass failure and rockfall, measures include protective mesh with rock bolting at locations with planar or wedge failure potential, passive rockfall barriers, protective embankments where space permits, and



slope scaling and cleaning. For landslides, measures include slope unloading and reprofiling to safer gradients with intermediate stabilising berms, surface water collection ditches, French drains and subhorizontal drains for groundwater control, gabion and reinforced concrete retaining structures, and slope stabilisation with reinforced earth. For debris flow hazards at tributary crossings, upstream retention basins, selective weirs, and steel or gabion barriers are to be designed based on hydraulic calculations of the catchment area; all crossing structures in debris flow corridors are designed with a minimum freeboard of 2.0 m and wide free-flow hydraulic sections to accommodate solid transport. For riverbank erosion, longitudinal protection with gabion mattresses and Reno mattresses, and transversal groynes, are the primary measures. For swampy areas with soft foundation conditions, permanent drainage and soft soil replacement or geotextile base reinforcement are proposed.

Road Safety Infrastructure

Road safety measures will be incorporated throughout the corridor, including guardrails, road signage, lane markings, and local traffic management features. Enhanced safety treatments will be applied in the vicinity of settlements and community infrastructure, particularly near Shahidon (km 31) and Mullokoni (km 54), where the road passes through or close to settlement areas.

2.3.6. Construction Materials, Borrow Areas and Spoil Disposal

Construction of the project will require significant quantities of aggregates, asphalt, concrete, reinforced concrete components, steel, stone, and fill materials for road works, culverts, bridges, retaining walls, drainage systems, and river protection structures. The design documentation notes that field and laboratory investigations were undertaken to assess available soil reserves adjacent to the route, with the intention of identifying suitable materials for roadbed and concrete works.

Construction Materials

The primary materials required for road construction include:

- Aggregates for pavement base and sub-base layers;
- Asphalt for road surfacing;
- Sand and gravel for concrete production;
- Stone materials for erosion protection, gabions, and riprap;
- Reinforced concrete components for bridges and culverts;
- Steel reinforcement and structural elements for bridges and retaining structures.

In addition to pavement materials, significant quantities of stone and concrete materials will be required for bridges, culverts, retaining walls, and riverbank protection structures associated with the road alignment.

Where possible, construction materials will be sourced locally to reduce transportation distances and associated environmental impacts. The project design promotes resource efficiency through the reuse of excavated materials and reclaimed asphalt pavement where technically feasible. Culvert pipes will be reinforced concrete or HDPE; the use of asbestos-cement pipes is not acceptable given the occupational health risks associated with asbestos fibres, and this restriction will be specified in the project's environmental and social requirements for the contractor.

Material Requirements and Earthworks Balance

The Project requires substantial quantities of fill material for embankment construction, sub-base and base course aggregate, stone for erosion protection and gabion structures, and concrete materials for bridges, culverts, and retaining walls. Borrow areas and quarries will be required to supply suitable soil, sand, gravel, and rock for embankment construction, pavement layers, structural concrete, and



erosion protection. Earthworks calculations based on cross-sectional profiles of the road formation¹ indicate the following quantities:

Table 4: Earthworks Material Balance²

	Section 1	Section 2	Total
Embankment fill required (incl. compaction factor)	697,643 m ³	1,357,051 m ³	2,054,694 m ³
Total excavation	1,719,709 m ³	960,206 m ³	2,679,915 m ³
of which unsuitable for reuse (siltstone, sandy clay)	1,158,137 m ³	766,281 m ³	1,924,418 m ³
Suitable excavated material available for reuse	561,572 m ³	193,925 m ³	755,497 m ³
Estimated borrow material deficit			~1,299,000 m ³
Surplus requiring disposal			~1,924,000 m ³

Source: IEE (2025); Kocks Consult / DITI (2025).

This balance indicates that approximately 1.3 million m³ of fill material will need to be sourced from borrow areas, and approximately 1.9 million m³ of unsuitable excavated material will require disposal. These are indicative figures based on feasibility-stage design; final quantities will be confirmed through detailed design.

Proposed Borrow Reserves

Geotechnical investigations have identified the presence of suitable soil and rock resources within the wider project area. These are all located in the floodplain of the Shurobdaryo and are summarised in Table 5 below. The exact locations of borrow areas and quarries have not yet been finalised and will be confirmed during the detailed design and contractor mobilisation stages. Potential borrow areas may also be located within or outside the immediate road corridor depending on the availability and quality of construction materials identified during further investigations.

Table 5: Proposed Borrow Reserves

Reserve	Location	Chainage	Material	Intended Use
BR1	Surkhob River floodplain	(~km 1–25)	Pebble with boulders (up to 30%); granites, quartzite limestones, sandstones; max grain 500mm	Embankment fill and lower earth bed layers
BR2	Surkhob River floodplain	(~km 25–30)	Clayey soil (up to 70%), pebble; quartzite limestones, sandstones; max grain >700mm	Embankment fill; crushed stone production
BR3	Surkhob River floodplain, multiple sub-sections	(~km 33–54)	Pebble gravel, clumps up to 30%; limestones, sandstones; max grain 500mm	Embankment fill; crushed stone production

Source: PIURR

All reserves are located on active floodplain deposits of the Shurobdaryo and are accessed via the project road. Material quality must be verified through laboratory testing of at least six test pits per

¹ (Kocks Consult / DITI, 2025)

² Note: Earthworks quantities are currently being verified against detailed design calculations. Figures will be updated prior to disclosure.



reserve before extraction commences, and the reserves have not yet been formally agreed with local authorities or the Committee for Environmental Protection (CEP). The use of these deposits as embankment fill is technically feasible based on the geotechnical investigations and is the proposed primary borrow strategy.

Siting of any individual borrow area within these reserves is subject to mandatory constraints set out in the ESMP (Section 3.2) and Biodiversity Management Plan (ESMP Annex 8, Section 5.3): a minimum 100 m setback from the Shurobdaryo and named tributaries; exclusion from any Priority Biodiversity Feature buffer or no-go zone identified in the Critical Habitat Assessment and Sensitive Feature Register; exclusion from intact or semi-natural vegetation where a disturbed or degraded alternative is available; exclusion from the 1-in-100 year flood extent; and a preference for already-disturbed ground. The Contractor shall complete a Borrow Area Suitability Assessment for each proposed site, and the Ecologist must confirm in writing that the location is acceptable before any site preparation begins.

Extraction at any approved location is then conditional on a set of national permits and assessments. The applicable framework includes the Water Code (2000), which requires a Special Water Use Permit under Article 74 for works in or near water bodies; the Law on Mineral Resources (1994), which requires a subsoil-use licence for extraction of construction materials; the Land Code, which governs temporary land use authorisation; and the Law on Environmental Protection (2011) together with the Law on Environmental Impact Assessment (2018), which establish the State Ecological Expertise process administered by the CEP. In addition to the overall State Ecological Expertise conclusion for the road project, each riverbed or floodplain reserve will require: (i) a project-specific CEP environmental permit; (ii) a Special Water Use Permit; (iii) a Hukumat land allocation agreement; and (iv) a subsoil-use licence. Grant of these permits is conditional on a hydraulic assessment confirming that extraction will not alter river morphology or increase flood risk, and an aquatic biodiversity impact assessment. The procedural requirements are captured in ESAP items 6.3 (camp and borrow area siting) and 6.6 (riverbed/floodplain extraction); contractor obligations are incorporated in the bid package and the CESMP submission required before mobilisation. Each reserve will be subject to environmental monitoring during operation.

Spoil Disposal Sites

Sixteen locations for disposal of surplus excavated material have been identified along the corridor from approximately km 2 to km 38, with a combined indicative capacity of approximately 8.4 million m³ — substantially exceeding the estimated surplus of ~1.9 million m³. Disposal sites have not yet been formally agreed with local authorities and require approval before use. The identified locations are shown in Figure 11 and listed in Table 6.



Table 6: Identified Spoil Disposal Sites





No.	Location	Approx. km	Indicative Volume (m ³)
1	Near Baljuvon	2	300,000
2	Degikham	6	500,000
3	Khorma	9	1,500,000
4	Khoram A	10	100,000
5	Khoram B	11	300,000
6	Bridge No. 1	15	2,500,000




7	Between Bridge 1 and Doshmandi	16	200,000
8	Between Doshmandi and Dashtikil	20	150,000
9	Dashtikil	21	300,200
10	Between Dashtikil and Toydara	22	250,000
11	Toydara	24	700,000
12	Shahidon	30	400,000
13	Dashtaroh	32	100,000
14	Sadahoh	33	280,000
15	Bridge 5	35	163,700
16	Bridge 6	38	700,000
	Total identified capacity		~8,444,000 m³




Source: PIURR




Figure 11: Approximate Soil Disposal Locations


No. Dump Objects	Location walking,	For the section, km	Location map	Spoil, volume m3
1	Near Baljuvan	2 km		300-000
2	Degi kham	6 km		500-000

No. Dump Objects	Location walking,	For the section, km	Location map	Spoil, volume m3
3	Khorma	9 km		1500-000
4	Khoram	10 km		100-000
5	Khoram	11 km		300-000
6	Bridge N.o 1	15 km		2500-000

No. Dump Objects	Location walking,	For the section, km	Location map	Spoil, volume m3
7	Between Bridge N.o 1 and Doshmandi	16 km		200-000
8	Between Doshmandi and Dashtikilko	20 km		150-000
9	Dashtikilko	21 km		300-200

No. Dump Objects	Location walking,	For the section, km	Location map	Spoil, volume m3
10	Between Dashtikilko and Toydara	22 km		250-000
11	Toidar	24		700-000
12	Shahidon	30 km		40-000

No. Dump Objects	Location walking,	For the section, km	Location map	Spoil, volume m3
13	Dashtaroh	32km		100-000
14	Sadaho	33 km		280-000
15	Bridge 5	35 km		163-700

No. Dump Objects	Location walking,	For the section, km	Location map	Spoil, volume m3
16	Bridge 6	38 km		700-00

The 16 disposal sites listed above are an indicative PIURR-provided list. Locations are not yet formally agreed with local authorities. They are subject to the mandatory siting criteria set out in ESMP Annex 6 (Materials, Spoil & Borrow Area Management Plan), Section 4.2, supplemented by the general ancillary-facility siting rules in Biodiversity Management Plan Annex 8, Section 5.3. Together these establish the following exclusions:

- no disposal within the active channel, banks, or floodplain of the Shurobdaryo or any permanent or seasonal tributary without written authorisation from the relevant water authority and the Engineer;
- no disposal on slopes exceeding 25° or in areas of active mass movement or landslide risk;
- no disposal on productive agricultural land without documented landowner consent, compensation, and an agreed reinstatement plan;
- no disposal within or within 100 metres of ecologically sensitive habitats identified under the Biodiversity Management Plan;
- no disposal within any Priority Biodiversity Feature buffer or no-go zone identified in the Critical Habitat Assessment and Sensitive Feature Register, or in intact or semi-natural vegetation where a disturbed or degraded alternative is available;
- no disposal within 100 metres of any known cultural heritage site, cemetery, or sacred area; and
- no disposal within 500 metres of a settlement, school, or health facility without specific Engineer approval and community notification.

Because the road alignment runs adjacent to or within the Shurobdaryo floodplain for extended sections, floodplain proximity is structural to the corridor rather than an exception, and several of the listed sites are likely to sit in or near the floodplain. Disposal in the floodplain is not prohibited but requires the special authorisation route described in the first criterion above — a procedurally demanding test that includes hydraulic assessment, water authority consent, and ESAP item 6.6 compliance.

A desktop-level screening of the 16 indicative sites against the harder, non-discretionary tests is set out below, pending site-specific Suitability Assessment by the Contractor.

Table 7: Preliminary Borrow Pit Screening

Risk type	Sites	Why
Settlement proximity (500 m setback)	Near Baljuvon (km 2), Khorma (km 9), Khoram A/B (km 10/11), Dashtikil (km 21), Toydara (km 24), Shahidon (km 30), Dashtaroh (km 32)	Sites named for settlements may sit within the 500 m setback from settlements, schools, or health facilities. Shahidon (km 30) is the only health facility on the corridor and warrants additional caution. Toydara (km 24) has the highest concentration of affected residential plots in the corridor.
Floodplain / watercourse — special authorisation route	Bridge No. 1 (km 15), Bridge 5 (km 35), Bridge 6 (km 38), plus any other site sited in the active floodplain	Bridge sites are at watercourse crossings and are almost certainly in the floodplain. These sites are not excluded but require water authority authorisation, hydraulic assessment, and Engineer approval before use.
Most likely to satisfy criteria — between-settlement open sites	Degikham (km 6), Between Bridge 1 and Doshmandi (km 16), Between Doshmandi and Dashtikil (km 20), Between Dashtikil and Toydara (km 22), Sadaho (km 33)	Names suggest open ground between settlements. Most likely to satisfy the settlement and watercourse criteria, but still subject to per-site assessment for slope, agricultural land, biodiversity and cultural heritage tests.

The combined indicative capacity of approximately 8.4 million m³ exceeds the estimated surplus (~1.9 million m³) by a factor of approximately 4.4, providing substantial scope to drop sites that fail the criteria without compromising the disposal strategy. Each disposal site requires Engineer approval and entry in the Spoil Disposal Site Register before use, and the per-load tracking system specified in the ESMP applies to all approved sites.

2.3.7. Construction Camps, Ancillary Facilities, and Roadside Service Structures

In addition to the core road works, the Project will require a range of temporary and ancillary facilities during construction. The principal facility is one or more main construction camps, which will serve as the operational base for the Contractor's workforce throughout the construction period. Given the remote and linear nature of the BSK corridor, the construction camp will need to be largely self-sufficient, providing all utilities, services, and accommodation for the resident workforce on-site rather than relying on local community infrastructure.

The main construction camp is expected to include the following facilities:

a) **Accommodation and welfare:** Sleeping quarters for resident workers, typically in prefabricated or modular units; a canteen and food preparation facilities serving all three daily meals; common recreation and rest areas; sanitary blocks with showers, toilets, and washing facilities; and a medical room with first aid equipment and qualified first aid personnel. Separate facilities will be provided for any female workers. The camp will be fenced and access-controlled.

b) **Management and administration:** Site offices for Contractor management, engineering staff, and the Environmental and Social Health and Safety (ESHS) Manager; meeting rooms; communications equipment; and document storage. The Supervising Engineer and PIURR supervision staff will also require on-site office accommodation.

c) **Utilities:** Generator-based power supply, given the absence of reliable grid electricity along much of the upper corridor (though grid connections exist in lower valley settlements). Potable water supply from a dedicated source independent of community water systems — either borehole, treated river water, or bottled supply for drinking. Wastewater management through septic tanks, package treatment units, or sealed holding tanks with off-site disposal, in compliance with Tajik sanitary norms



and EBRD ESR3 discharge requirements. Solid waste storage and scheduled collection or on-site disposal.

d) **Operational facilities:** A contractor's yard including equipment parking, maintenance workshop, and fuel storage area with secondary containment; materials laydown and stockpile areas; secure storage for hazardous materials (fuels, lubricants, bitumen, chemicals) in bunded compounds; and potentially a concrete batching plant and/or aggregate crushing facility depending on contractor arrangements.

The camp footprint will depend on the final workforce size and contractor methodology but is likely to require several hectares of levelled ground. Given the constrained valley topography of the BSK corridor, site selection will be challenging and is one of the key environmental screening tasks during contractor mobilisation.

Satellite Camps and Forward Work Bases - Given the corridor length of approximately 56 km and the absence of through-road access during construction, it is likely that the Contractor will also establish one or more satellite camps or forward work bases at intermediate points along the alignment to avoid excessive travel time for workers and materials. These would typically be smaller facilities providing rest, welfare, and tool storage for specific construction crews, with personnel transported daily from the main camp or accommodated in smaller residential units. The location and scale of any satellite facilities will be confirmed during contractor mobilisation.

Asphalt and Concrete Production Facilities - The Project will require significant quantities of asphalt concrete for road surfacing and structural concrete for bridges, culverts, and retaining walls. Depending on contractor arrangements, an asphalt mixing plant and/or aggregate crusher may be established within or near the project corridor to avoid reliance on distant supply sources.

The locations of the main construction camp, satellite camps, asphalt and concrete plants, and other ancillary facilities have not yet been identified and will be confirmed during contractor mobilisation. All such facilities are subject to the same mandatory siting constraints as borrow areas and spoil disposal sites, set out in Biodiversity Management Plan Annex 8 Section 5.3 (Camp, Borrow Area, and Plant Siting), supplemented by camp-specific water quality and noise requirements in ESMP measure C-HY-04. Together these establish the following exclusions:

- no siting within 200 metres of the Shurobdaryo or any named tributary (a tighter setback than the general 100 metres applicable to other ancillary facilities, reflecting the additional risk from sewage and concrete-washout discharges associated with camp activities);
- no siting within 500 metres of residential areas, to manage operational noise impacts;
- no siting within any Priority Biodiversity Feature buffer or no-go zone identified in the Critical Habitat Assessment and Sensitive Feature Register;
- no siting within intact or semi-natural vegetation — including riparian scrub, shrubland, or grassland — where a disturbed or degraded alternative is available within a reasonable distance;
- no siting within the 1-in-100 year flood extent of the Shurobdaryo or any tributary; and
- a preference for already-disturbed ground (existing road formation, degraded agricultural land, or previously cleared areas) over undisturbed or semi-natural land.

The Contractor shall complete a Suitability Assessment for each proposed camp, plant, or ancillary facility location, and the Ecologist shall confirm in writing that the proposed location is acceptable before any site preparation work commences. Hukumat (local authority) permission for temporary land use is required for each site, and where a site involves private or community land, documented landowner consent and PIURR confirmation of any associated compensation are pre-requisites under ESMP measure C-PC-02a. Camp siting is also subject to ESAP item 6.3 (camp locations away from



ecologically sensitive areas) and the ESMP Worker Accommodation & Camp Management Plan (Annex 10).

2.3.8. Construction Workforce

The construction workforce required for a project of this scale and complexity is expected to be substantial, though the precise numbers will depend on the Contractor's methodology, equipment programme, construction programme, and the extent of subcontracting. Based on the scope of works the peak construction workforce is estimated at between 300 and 500 workers during the most intensive phases of concurrent earthworks, bridge construction, and pavement laying.

The workforce will comprise several distinct categories. Supervisory and technical staff — including the Contractor's site management, resident engineers, survey crews, and quality control personnel — are likely to number 30–50 individuals. Skilled trades required for specialist operations include bridge construction workers (formwork, reinforcement, concreting), plant operators for heavy earthmoving and paving equipment, asphalt plant technicians, blast operators (where rock cutting is required), and welders and fabricators for metalwork. Semi-skilled and unskilled workers will make up the largest proportion of the workforce, undertaking manual earthworks support, materials handling, drainage installation, slope protection, and general construction labour. Support staff operating the construction camp — cooks, cleaners, drivers, security, and medical personnel — will add further to the on-site total.

A proportion of the workforce, particularly unskilled and semi-skilled roles, will be recruited locally from communities along the corridor in line with the Project's commitment to local employment. Specialised trades and management staff will largely be sourced from outside the area, with a significant proportion likely to be non-Tajik workers depending on the nationality of the successful Contractor.

Supply chain workers — including those employed at aggregate quarries, material processing facilities, and other upstream suppliers engaged by the Contractor — are recognised as a relevant category under EBRD ESR2. Supply chain labour risks are assessed in Section 7.13 (Labour and Working Conditions).

2.3.9. Construction Plant and Equipment

The construction of the BSK road will require a substantial fleet of heavy plant and equipment deployed across multiple active work fronts along the corridor. The following categories of equipment are expected to be mobilised:

- *Earthmoving and formation works:* Crawler-mounted hydraulic excavators (20–40 tonne class) for bulk excavation, slope cutting, and foundation excavation; bulldozers (D6–D9 class or equivalent) for formation clearing, topsoil stripping, and rough grading; motor graders for fine grading of formation and sub-base layers; wheeled loaders for stockpile management and material loading; articulated dump trucks (25–40 tonne capacity) for earthworks haulage along the corridor and to disposal sites; scrapers or tractor-scraper combinations for large-volume cut-to-fill earthmoving where terrain permits; and compactors (vibrating drum and padfoot rollers) for embankment and subgrade compaction. Given the 1.9 million m³ of unsuitable excavated material requiring haul to disposal sites spread along the corridor, a substantial dump truck fleet will be required — potentially 20–30 vehicles operating across multiple sections simultaneously at peak production.
- *Rock breaking and blasting:* Hydraulic rock breaker attachments on excavators for routine rock cutting; drilling rigs for controlled blasting where required in hard rock cut sections; and associated equipment for drill, blast, and muck operations in geologically demanding sections.
- *Drainage and structures:* Crane lorries and hydraulic cranes (50–100 tonne capacity) for placement of precast concrete culvert elements, bridge beams, and retaining wall panels;



concrete mixer trucks and static batching equipment; vibrators and formwork for in-situ concrete; and pipe-laying equipment for culvert installation.

- *Bridge construction:* Piling rigs for driven or bored pile foundations at the eight major bridge crossings; crane and gantry systems for beam erection; formwork systems for cast-in-situ deck construction; concrete pumps; and water management equipment (sheet piling, dewatering pumps) for in-channel works during dry season windows.
- *Pavement construction:* Cold planer/milling machine for removal of any existing bound layers; aggregate crushing plant (jaw and cone crushers) for production of sub-base and base course material from borrow reserves; asphalt mixing plant (batch or drum mix type, capacity 80–160 t/hr) for production of wearing and binder course material; asphalt paver with screed for laying; pneumatic tyred and steel drum rollers for asphalt compaction; and bitumen tankers.
- *River protection and slope stabilisation:* Long-reach excavators for bank protection and gabion installation; stone and rock placing equipment; concrete spraying equipment (shotcrete) for slope stabilisation where specified; and geotextile installation equipment.
- *Ancillary plant:* Water bowzers for dust suppression and concrete curing; fuel bowzers; mobile workshops and service trucks; generators; survey equipment; and safety and traffic management vehicles.

Given the linear nature of the corridor and the constrained mountain valley topography, the Contractor will need to manage a distributed plant fleet across multiple simultaneous work fronts, with equipment mobilised and demobilised to sections as the construction programme progresses from one reach to the next. The remoteness of the upper corridor (km 36–56, where there is currently no formed road) will require particular logistical planning for plant mobilisation, fuelling, and maintenance before the new formation is established.

2.4. Project Phases

The Project will be implemented over a series of defined phases, as follows.

2.4.1. Pre-construction

The pre-construction phase will include permitting, land acquisition, and mobilisation of contractors. Given the complexity of the BSK corridor — its mountain valley setting, active geohazard environment and the significant earthworks and river works programme — the pre-construction phase carries substantial preparatory requirements that must be completed before any physical works commence. Key activities include:

Regulatory permitting and approvals: A range of permits and approvals must be obtained before construction activities can commence. The Contractor is responsible for obtaining its own suite of permits before undertaking the relevant activities, including: construction activity licensing from the Ministry of Economic Development and Trade; temporary land use permits for construction camps, asphalt and concrete plants, and borrow areas from the relevant Hukumats; special water use (abstraction and supply) approvals from the CEP/Basin Water Organisation; vegetation removal permits from the CEP before any clearance where trees or shrubs are affected; air emission permits (MPE) from the CEP for stationary and mobile sources including the asphalt plant and aggregate crushers; discharge permits (MPD) from the CEP where applicable; borrow pit and quarry operating permits and asphalt plant approvals from the CEP; and waste storage and disposal arrangements with local authorities. No activity requiring regulatory approval shall commence before the relevant permit has been obtained and recorded in the Contractor's Legal and Permits Register, which must be established prior to mobilisation and reviewed monthly throughout construction.

Land acquisition and resettlement: No construction works, site establishment, or ancillary facility development shall commence on any parcel of land until PIURR has confirmed in writing that



compensation for that parcel has been paid in full and that the affected party has been notified. The Contractor must maintain a land access log recording written confirmation from PIURR for each section before works commence.

Associated facilities screening and approval: Identification and environmental screening of locations for construction camps, satellite facilities, asphalt mixing plant, concrete batching plant, aggregate crusher, borrow areas, and spoil disposal sites. Final siting of all associated facilities requires pre-approval by the Engineer and PIURR, and in some cases by the CEP, before establishment. Borrow area extraction permits must be obtained from the CEP before any material extraction commences.

Contractor CESMP preparation and approval: The Contractor is required to prepare the CESMP and all required topic-specific sub-plans prior to mobilisation and before the relevant works start. The CESMP must be approved by the Engineer and PIURR (and by the CEP where applicable) before any works commence. The CESMP must incorporate all conditions of the SEE conclusion. No physical works on the road formation may commence until this approval has been received.

Traffic management coordination: The Traffic Management Plan must be submitted to local traffic authorities prior to construction, with public information on disruptions and coordination on haul routes. This plan must be updated as works progress.

Potential environmental and social risks during this phase include delays to RP implementation affecting vulnerable households, failure to complete the biodiversity field survey programme before the construction season begins, selection of camp or borrow sites in environmentally sensitive locations without adequate screening, and inadequate integration of ESHS requirements into the detailed design — particularly drainage, slope stability, and Red Book species avoidance.

2.4.2. Construction

The construction phase will involve physical works along the road corridor and at all associated facilities over an estimated construction period of three years. Given the corridor length, the volume of earthworks, the number of bridge structures, and the constraints imposed by seasonal accessibility, construction will be sequenced across multiple work fronts operating concurrently. Key activities are expected to include:

Vegetation clearance and site preparation: Stripping and stockpiling of topsoil within the construction footprint; clearance of existing vegetation, shrubs, and isolated trees within the road formation and associated works areas; removal of existing road structures, culvert pipes, and deteriorated formation material; and protection or relocation of utilities and community infrastructure (water pipelines, overhead power lines) displaced by the new formation. Vegetation clearance must be timed to avoid the bird breeding season (April–July) at locations where nesting of Red Book species has been confirmed or cannot be ruled out.

Earthworks and formation: Bulk cut-and-fill earthworks to establish the road formation. This includes deep rock and soil cuts on the numerous cut sections, construction of embankments across floodplain and valley floor sections, and haulage of approximately 1.9 million m³ of unsuitable excavated material to the 16 identified disposal sites along the corridor. In the most geologically challenging sections — particularly where siltite and sandy clay materials are encountered — controlled blasting may be required for rock excavation, with associated blast vibration, noise, and dust management requirements. Earthworks in the upper corridor (approximately km 36–56) will be particularly demanding given the absence of any existing formed road and the need to establish the formation through terrain with active landslide, mudflow, and debris flow processes.

Drainage and hydraulic structures: Installation of the full corridor drainage system, comprising longitudinal side ditches, cross-drainage culverts, and cut-off channels on slope sections. Culvert installation will require temporary diversion or management of ephemeral and seasonal flows. In-channel works at the seven largest tributaries will require careful seasonal scheduling to avoid the



spring snowmelt and flood peak (April–May), when flows carry high debris loads and in-channel access is unsafe.

Bridge construction: Construction of eight major bridge structures, including foundation works (driven or bored pile foundations or spread footings depending on ground conditions), abutment and pier construction, beam erection or in-situ deck casting, and installation of bridge parapets, expansion joints, and bearings. In-channel foundation works at the four principal river crossings (Bridges 4, 5, 8 and 9) should be confined to the dry season window (approximately June to September) to avoid impact on confirmed Amy Darya trout autumn spawning migration (October–November) and spring flood peak flows. These bridges cross the Shurobdaryo at sections where the active channel carries design discharges of up to ~480 m³/s and the floodplain can be inundated across its full width.

Slope stabilisation and geohazard management: Implementation of stabilisation measures at hazard locations along the corridor, including slope benching and grading, installation of retaining walls and gabion crib structures, rockfall netting and catch fences, surface drainage on unstable slopes, and revegetation of cut faces. These works will proceed in parallel with earthworks and will require continuous geotechnical monitoring to detect early signs of instability triggered by construction disturbance.

River protection and bank stabilisation: Construction of shore protection works along the Shurobdaryo corridor, including stone masonry revetments, gabion mattresses and walls, concrete slab protection, and riprap at bridge abutments and embankment toes. Bank protection works are essential at all sections where the road runs along or close to the active channel, given the river's naturally high flood energy and tendency for lateral channel migration. River protection works require in-channel or bankside operations and carry direct potential impacts on aquatic habitat and the Eurasian Otter.

Pavement construction: Following completion and acceptance of the formation and sub-base, construction of the pavement structure comprising compacted sub-base (crushed stone-sand mix C4, 200mm), asphalt binder course (Type B dense mix, 80mm), and asphalt wearing course (Type B fine-grained hot mix, 60mm). Pavement works will be the most traffic-disruptive phase for local communities, as they require a continuous paved surface to be laid without damage from construction vehicles. Asphalt paving will be constrained to the warm season (approximately May–October) when ambient temperatures permit satisfactory asphalt laying and compaction.

Settlement works: Specific works within the six settlement areas along the corridor, including carriageway widening to the wider cross-section types (Types 7 and 8), installation of kerbs, footways, and pedestrian crossings, relocation of utility lines and poles, installation of street lighting, and construction of permanent roadside service structures (restrooms and camping facilities). Works within settlements will present the most acute community health, safety, and access disruption risks, requiring rigorous traffic management and community liaison.

Finishing works: Installation of road safety furniture including guardrails, crash barriers, road markings, direction and warning signs, km markers, and speed restriction signs; seeding and revegetation of disturbed surfaces; landscaping and reinstatement of temporary works areas including camp sites, borrow areas, and access tracks; and demobilisation of all temporary facilities.

2.4.3. Operation and Maintenance

The operation and maintenance phase will commence following completion of construction and commissioning of the upgraded road. The Ministry of Transport of the Republic of Tajikistan, acting through PIURR, will be responsible for the long-term operation and maintenance of the road. Given the mountainous setting, high natural hazard exposure, and the scale of hydraulic and slope protection infrastructure incorporated into the design, an active and well-resourced maintenance regime will be essential to the long-term performance and safety of the road.



Routine and periodic maintenance activities are expected to include pavement surface inspection and repair, pothole filling and patching, carriageway cleaning and debris clearance, drainage system inspection and clearance (culverts, side ditches, outlet structures, and drainage channels), road marking and signage replacement, and inspection and minor repair of guardrails and safety barriers.

Maintenance of the hydraulic and slope protection infrastructure will be particularly important and demanding. Gabion mattresses, Reno mattresses, groynes, and riverbank protection structures are subject to damage during high-flow and debris transport events and will require post-event inspection and repair. Selective weirs and retention basins at debris flow corridors will require emptying of accumulated material following each significant event. Rockfall mesh and barriers will require periodic inspection for damage or overloading.

Given the history of road closures during winter and periods of heavy rainfall, the operation phase will also require active monitoring of slope conditions and watercourse behaviour along the corridor, with protocols for temporary road closure and emergency repair following significant natural hazard events. The road operator should maintain contact with meteorological and disaster risk authorities to receive early warning of extreme weather events that may trigger debris flows, landslides, or flooding along the corridor.

Potential risks during operation include increased traffic speeds and volumes relative to current conditions, road safety risks for vulnerable road users including pedestrians and livestock near settlements, noise and air quality impacts near settlements, and longer-term induced development effects associated with improved accessibility — including increased tourism and mining-related traffic — which may accelerate traffic growth beyond the rates assumed in the design.

2.5. Associated Facilities

Associated facilities for the purposes of the ESIA are those facilities and activities that are not part of the core road works but are required to support construction and operation of the Project, and which would not be developed or operated independently of the Project, in accordance with EBRD Environmental and Social Requirement 1 (ESR1).

2.5.1. Identification of Associated Facilities

The associated facilities required to support the Project have been identified to the extent possible at this stage. Construction camps, borrow areas, asphalt and concrete batching plants, aggregate crushing facilities, material storage and laydown yards, temporary access roads and haul routes, spoil disposal areas, and waste management facilities will all be required. The general need for each of these facility types is confirmed; however, the exact locations, sizes, and operating arrangements for a number of them have not yet been finalised and will depend on detailed design and contractor proposals.

All associated facilities are assessed within this ESIA. Where sufficient information is available, the assessment is based on known or anticipated facility characteristics. Where locations or specifications remain undetermined, a precautionary approach has been taken, assessing risks and impacts on the basis of reasonable worst-case assumptions consistent with the scale and setting of the Project. Site-specific assessment of individual facilities will be undertaken by the Contractor as part of the Construction Environmental and Social Management Plan (CESMP) prior to commencement of works at each location.

The potential for induced development associated with improved road access — including tourism and extractive industry activity in the Baljuvon district — is addressed in Section 7.

3. Policy, Legal and Administrative Framework

3.1 General

This section provides an overview of the policy, legal, and administrative framework applicable to the Project. It identifies the relevant national legislation of the Republic of Tajikistan, the requirements of the EBRD ESP (2024) and applicable ESRs, and relevant EU substantive environmental standards. The Project will be required to comply with all applicable national and international environmental and social policies, guidelines, and performance requirements, with the more stringent standard applying in cases of inconsistency.

3.2 National Policy and Legal Framework

3.2.1 General Framework

The environmental and social legal and regulatory framework in Tajikistan is comprehensive and encompasses a wide range of topics, reflecting the country's commitment to environmental and social protection and sustainable resource management. The laws address key topics, including Protection of the environment, ecological audit and monitoring, protection of flora and fauna, environmental information and education, soil, water and air quality, biological safety, human health and safety, and waste and chemicals management.

This legal structure, reinforced by the Constitution, strategic documents, state programs, and international agreements, creates a favorable environment for environmental conservation and the responsible use of natural resources. It involves various governmental bodies, including the Parliament, the President, ministries, state committees, and local authorities, ensuring a collaborative multi-level approach to environmental governance.

The legal framework in Tajikistan goes beyond regulatory aspects by prioritizing citizens' entitlements, including the right to a secure environment, access to environmental information, and active participation in initiatives to improve ecological conditions.

The main environmental laws that should be followed by the Project are listed in Table 8.

Table 8: Relevant E&S Laws of Tajikistan

№	Name of the documents	Date approved
In the field of environmental protection		
1.	Law "On Environmental Protection"	August 2, 2011
2.	Law "On Ecological Expertise"	April 16, 2012
3.	Law "On Environmental Impact Assessment"	November 1, 2018
4.	Law "On the protection of atmospheric air"	December 28, 2012
5.	Law "On production and consumption waste"	May 10, 2002, amended in 2011
6.	Law "On Environmental Monitoring"	March 25, 2011
7.	Law "On the protection and use of flora"	May 17, 2004
8.	Law "On Biological "Security"	March 1, 2005

Nº	Name of the documents	Date approved
9.	Law "On fauna"	January 5, 2008
10.	Law "On Soil Protection"	October 16, 2009
In the field of health, social protection and emergency situations		
1.	Law "On protection of population and territories from emergency situations of natural and man-made character"	July 15, 2004
2.	Law of Republic of Tajikistan on Appeals of Individuals and Legal Entities	2016
Codes		
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.	Labour Code of the Republic of Tajikistan	2016
4.	Health Code (the Law No. 1413)	March 15, 2017
5.	Forest Code of the Republic of Tajikistan	August 2, 2011
6.	Law "On Environmental Audit"	December 26, 2011
7.	Law "On Specially Protected Natural Territories"	December 26, 2011
8.	Law "On Environmental Monitoring"	March 25, 2011
9.	Law "On Radiation Safety"	August 1, 2003
10.	Law "On the protection and use of flora"	May 17, 2004
11.	Law "On Biological Security"	March 1, 2005
12.	Law "On fauna"	January 5, 2008
13.	Law "On Soil Protection"	October 16, 2009
14.	Law "On hydrometeorological activity"	December 2, 2002
In the field of energy, industry and minerals		
1.	Law "On Energy Saving"	May 10, 2002
2.	Law "On mineral resources"	July 20, 1994
3.	Law "On industrial safety of hazardous production facilities"	February 28, 2004
In the field of water and land relationship, agriculture		

Nº	Name of the documents	Date approved
1.	Law "On drinking water and drinking water supply"	December 29, 2010
2.	Law "On Land Reform"	March 5, 1992
3.	Law "On Land Valuation"	May 12, 2001
4.	Law "On Land Management"	January 5, 2008, amended 2016
5.	Law "On the production and safe handling of pesticides and agrochemicals"	April 22, 2003

3.2.2 Law on Environmental Protection

The Law on Environment Protection, the so-called “framework environment law”, was adopted in 2011 (21 July 2011, Nº 208) and provides the overarching environmental framework within which the Project will be implemented. The previous Law on Nature protection was adopted in 1993 and amended in 1996, 2002, 2004 and 2007. In 2011 it was replaced by the new Law. The Law defines the applicable legal principles, the protected objects, the competencies and roles of the Government, the State Committee for Environment, the local authorities, public organizations and individuals. The Law also defines measures to secure public and individual rights to a safe and healthy environment and requires a combined system of ecological expertise and environmental impact assessment of any decision on an activity that could have a negative impact on the environment. The Law defines environmental emergencies and ecological disasters and prescribes the order of actions in such situations, defines the obligations of officials and enterprises to prevent and eliminate the consequences, as well as the liabilities of the persons or organizations that caused damage to the environment or otherwise violated the Law. The Law establishes several types of controls over compliance with environmental legislation: State control, ministerial control, enterprise control, and public control. State control is affected by the Committee for Environment Protection, the Sanitary Inspectorate of the Ministry of Health, the Inspectorate for Industrial Safety and the Mining Inspectorate. Public control is carried out by public organizations or trade unions and can be exercised with respect to any governmental body, enterprise, entity or individual.

3.2.3 Environmental and Social Impact Assessment

There are three laws in the country that stipulate all aspects of the EA: (a) Law on Environment Protection; and (b) Law on Ecological Expertise and (c) Law on the Environmental Impact Assessment. The Chapter V, Articles 35-39 of the Law on Environment Protection (2011), introduces the concept of state ecological review (literally, state ecological “expertise” – SEE) which seeks to examine the compliance of proposed activities and projects with the requirements of environmental legislation and standards and ecological security of the society. The mentioned laws stipulate the mandatory cross-sectoral nature of SEE, which shall be scientifically justified, comprehensive, and objective and which shall lead to conclusions in accordance with the law. SEE precedes decision-making about activities that may have a negative impact on the environment. Financing of programs and projects is allowed only after a positive SEE finding, or conclusion, has been issued. The following activities and projects subject to state ecological review: a) draft state programs, pre-planning, pre-project, and design documentation for economic development; b) regional and sectoral development programs; c) spatial and urban planning, development, and design; d) environmental programs and projects; e) construction and reconstruction of various types of facilities irrespective of their ownership; f) draft environmental quality standards and other normative, technology, and methodological documentation that regulates economic activities; g) existing enterprises and economic entities, etc. The laws stipulate that all types of economic and other activities shall be implemented in accordance



with existing environmental standards and norms and shall have sufficient environmental protection and mitigation measures to prevent and avoid pollution and enhance environmental quality. The EA studies analyzing the short- and long-term environmental, genetic, economic, and demographic impacts and consequences shall be evaluated prior to making decisions on the siting, construction, or reconstruction of facilities, irrespective of their ownership. If these requirements are violated, construction will be terminated until necessary improvements are made, as prescribed by the Committee for Environmental Protection and/or other duly authorized control bodies, such as sanitary, geological, and public safety agencies.

Environmental Impact Assessment. An Environmental Impact Assessment (EIA) study is a component of the State Ecological Expertise, as set out in the 2011 amendments to the Environmental Protection Law. In 2012 the new Law "On Environmental Expertise" was adopted. In pursuance of this law, the Government subsequently adopted the following:

- The Procedure of environmental impact assessment (adopted by the Resolution of the Government of the Republic of Tajikistan as of 01.11.2018 №532): Guidelines on the composition, order of development, coordination and approval of design estimates for construction of facilities, buildings and structures and EIA chapters, SEA and feasibility documents;
- A List of objects and kinds of activity for which preparation of documentation for environment impact assessment is mandatory (adopted by the Resolution of the Government of the Republic of Tajikistan as of 01.11.2018 №532). The List is very extensive: it contains 180 types of activities, grouped according to four environmental impact categories: from A (in Cyrillic sounds A) "high risk" to Г (in Cyrillic sounds G) "local impact"). If the facility/activity is not included in the list, then it is not required to pass either an EIA or a SEE. The current system of environmental impact assessment does not provide for any preliminary assessment of the project to decide on the need for an EIA (screening), nor to define the scope of the issues covered and the content of EIA materials as specific procedural steps. The List of objects and activities for which the development of EIA materials is required is very detailed and, in the opinion of government bodies, for this reason there is no need to procedurally consider the issue of carrying out an EIA in each specific case.

The State Ecological Expertise for all investment projects is the responsibility of the Committee for Environmental Protection under Government of Tajikistan (CEP) and its regional offices. Furthermore, according to the 2012 Law on the State Ecological Expertise, all civil works, including rehabilitation, should be assessed for their environmental impacts and the proposed mitigation measures reviewed and monitored by the CEP. The Law "On Ecological Expertise" and the "Procedure on Environmental Impact Assessment" of 2013 lays down the principles of performing the EIA in Tajikistan.

Together with a detailed project description, the EIA study is the basis to go for the environmental permit and has to be submitted to the Committee. As a rule, the Committee prepares an expertise to the project within one month. In preparation of this expertise, all subdivisions that might be involved in the project do participate. With this expertise, the permission is given, is not given or given with requirements and obligations that have to be followed by the company during construction and/or during operation. If the Committee comes to the conclusion that an environmental permit cannot be given because e.g. limit values are exceeded or other environmental aspects are not sufficiently mitigated, the developer can change its design and submit the impact assessment again.

Types of Ecological Expertise. According to the 2011 Law on Ecological Expertise, ecological expertise is intended to prevent negative impacts on the environment as a result of a proposed activity, forecast impacts from activities that are not considered as necessarily damaging to the environment and create databases on the state of the environment and knowledge about human impact on the environment. This Law and the Law on Environment Protection envisage two types of ecological expertise – State ecological expertise and public ecological expertise, which are not given equal importance. While State ecological expertise is a prerequisite for beginning any activity that may have an adverse



environmental impact, public ecological expertise becomes binding only after its results have been approved by a State ecological expertise body. The State Ecological Expertise is authorized to invite leading scientists and qualified outside specialists to participate in the review. Approval should be issued within 30 days, unless the project developer agrees to an extension, and remains valid for two years, if the decision is positive. For very complicated projects the term of consideration and approval can be extended till 60 days. According to the Law on SEE the public ecological expertise of economic activities or other activities implementation of which can negatively impact the environment of the population which live in the relevant area can be carried out by any public organization and citizen. They have right to send the proposals to the responsible government bodies concerning environmental issues of implementation of planned activities; to receive information on results of conducted state ecological expertise from relevant responsible bodies. The materials reflecting the public expertise delivered to the experts' commission should be taken into consideration under preparation of conclusion of state ecological expertise and decision making on realization of expertise object. The public ecological expertise is carried out under the state registration of application of public organization. The registration can be done by local executive authorities (during 7 days) in place where the expertise activities are planned. The public organizations which are organizing this expertise, should inform the population of initiation of expertise and then on its results.

PIURR has obtained a positive SEE conclusion from the Committee for Environmental Protection. This ESIA has been prepared to meet EBRD requirements and is consistent with the national EIA materials submitted to support the SEE process. No construction works shall commence until all conditions of the SEE conclusion have been reviewed and incorporated into the Project's environmental and social management arrangements.

EA administrative framework. The Environmental Protection Law states that a SEE should be conducted by the CEP, which is designated as a duly authorized state environmental protection body. It has a comprehensive mandate that includes policy formulation and inspection duties. The CEP has divisions at oblast (region), city and rayon (district) level, in the form of Departments of Environmental Protection (DEPs), within the Hukumat (local administration) at each city or rayon. A small unit in the ministry is entrusted with guiding and managing both EIA and SEE. EIA preparation is the responsibility of the proponents of public- and private-sector projects, who, in addition to complying with various environmental standards, procedures, and norms, shall meet the standards of other sectors and environmental media line agencies, such as sanitary-epidemiological, geological, water, etc.

The national EIA procedure is set out in Government Order No. 532 (1 November 2018), which approved the procedure for environmental impact evaluation and the classification of planned activities, repealing earlier orders issued in 2013 and 2014. The procedure comprises four stages: (i) preparation of preliminary impact information and a specification or terms of reference for the assessment; (ii) preparation of EIA materials; (iii) public informing and consultation, including collection of written comments and documentation of how comments are addressed; and (iv) finalisation of EIA materials for submission to the CEP. A positive SEE conclusion is required prior to proceeding with Project implementation and related approvals or financing decisions.

3.2.4 Public Participation and Grievances

Article 12 of the Environment Protection Law proclaims the right of citizens to live in a favorable environment and to be protected from negative environmental impacts. Citizens also have the right to environmental information (Article 13), as well as to participate in developing, adopting, and implementing decisions related to environmental impacts (Article 13). The latter is assured by public discussion of drafts of environmentally important decisions and public ecological reviews. Public representative bodies have an obligation to take into consideration citizens' comments and suggestions.

In accordance with the Law on Environmental Expertise, citizens are granted the right to conduct Public Environmental Expertise (art. 7). Tajikistan is also party to the 1998 Aarhus Convention (July 17,



2001) that contains provisions for public EE. The 2014 Procedure (Order) for Conducting an EIA also describes procedures for public participation. Public participation procedures are envisaged for all categories of projects, although in practice they are mainly applied to Category A projects. The Procedure (Order) for conducting the EIA of 2018 changed the focus and timing of public discussions. Compared to the 2006 version of the Procedure for preparing EIAs which provided the opportunity for public inputs during the scoping stage while drafting the technical task, the 2018 version of the Procedure provides space for public discussions only after the preparation of the EIA report.

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 formalized way for the PMU to identify and resolve concerns and grievances.

3.2.5 Law on the Permit System (2023)

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 authorized state body in charge of regulating environmental audit.

3.2.6 Law of Republic of Tajikistan on Appeals of Individuals and Legal Entities (from July 23, 2016, №1339)

Contains legal provisions on established information channels for citizens to file their complaints, requests and grievances. Article 14 of the Law sets the timeframes for handling grievances, which is 15 days from the date of receipt that do not require additional study and research, and 30 days for the appeals that need additional study. These legal provisions will be taken into account by the Project Grievance Redress Mechanism.

3.2.7 Law on Environmental Information

The Law on Environmental Information (2011) is underpinned by Article 25 of the Constitution, which states that governmental agencies, social associations, and officials are required to provide each person with the possibility of receiving and becoming acquainted with documents that affect her or his rights and interests, except in cases anticipated by law. The Law defines the legal, organizational, economic, and social bases for providing environmental information and establishes the right of individuals and legal entities to receive complete, reliable, and timely environmental information. Article 4 provides the right of access to environmental information.

3.2.8 Law about Culture

Protection of cultural heritage is grounded in paragraph 44 of the Constitution, which requires all citizens to respect and protect historical and cultural monuments. The Law about Culture (No. 2033 as of January 3, 2024) establishes rights concerning cultural activities, including non-material cultural heritage, and requires protection, management, and monitoring of historical and cultural monuments. Material heritage is found in archaeological sites, sites of ancient settlement, tumuli, remnants of ancient settlements, castles, industries, channels, roads, ancient burial places, stone sculptures, graven images, antiquity items, and places of ancient settlements. The Ministry of Culture and its local representative offices are primarily responsible for protecting cultural heritage.

3.3 Labour and Working Conditions

3.3.1 Labour Code (2016)

The Labor Code (2016) prohibits forced labor and adult labor. The Labor Code prohibits discrimination in employment and sets the minimum age at which a child can be employed as well as the conditions under which children can work. The minimum employment age is 15, however, in certain cases of vocational training, mild work may be allowed for 14-year-olds. In addition, there are some labor



restrictions on what type of work can be done, and what hours of work are permissible by workers under the age of 18. The Code also establishes rules for minimum wages, leave, overtime, and has provisions for pregnant women and caretakers for children. It also sets the rules for settling disputes between workers and employers.

The Labor Code also sets requirements for occupational health and safety. It establishes the right of workers to work in places that are protected from exposure to dangerous and harmful factors. Employers are required to tell workers of risks and hazards of their jobs, and requires employers to provide personal protective equipment. Employers are required to provide compulsory social insurance against accidents, disease, or injuries associated with their jobs. The law gives workers the right to refuse to undertake work that violates labor protection requirements. In addition, workers engaged in hazardous working conditions are entitled to free medical and preventative care, additional paid leave and other benefits and compensation. In case of disability or death, employers must provide compensation in multiples of average annual earnings. Employers must train workers in performing their work safety and must provide for collective and personal protection of workers.

Accidents must be investigated. Finally, there must be a “labor protection service” if there are more than 50 employees.

3.3.2 Occupational Health and Safety

The occupational safety and health systems at enterprises are managed on the basis of the Labour Code of the Republic of Tajikistan and the Norms and Rules On Occupational Safety that describe the duties of the owner and the employer concerning occupational safety and health, the duties of the OHS officer, the procedure of financing OHS measures and guarantees of the right to labour protection. The owner of the enterprise and the employer are directly responsible for the compliance of employees with the occupational safety requirements in their workplaces. Law on Industrial Safety of Hazardous Production Facilities (2004)

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 localize 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.

3.3.3 Law on Fire Safety

Law on Fire Safety (July 21, 1994, No.995) establishes the general rules, organizational and economic principles of ensuring fire safety in the Republic, describes the duties of government bodies, non-governmental organizations, officials and individuals in combating fires.

3.3.4 State Environmental Program 2009–2019

The State Environmental Program 2009–2019, approved in 2009, represented the principal national environmental policy framework during the period of economic transition, and its standards and institutional arrangements continued to provide the baseline reference framework following the program's conclusion. It has since been succeeded by the State Environmental Program of the Republic of Tajikistan for 2023–2028 (Government Decree No. 53), which is now the operative national environmental policy framework. This program continues to oblige ministries, agencies, and local authorities to improve environmental conditions and ensure sustainable development, and informs the standards applied in this Project. Both programs sit within the broader framework of the National Development Strategy of the Republic of Tajikistan for the period until 2030 (NDS-2030), which establishes overarching national development goals including environmental protection and climate resilience.



3.3.5 Resettlement and Land Acquisition

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. There is no separate law that completely provides norms and mechanisms for the determination of the full and fair, market/replacement 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)³
- Land Code (amended in 2012)⁴
- Land Code (amended in 2008)⁵
- Civil Code (amended in 2007)⁶
- 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)⁷

3.3.6 Types of land ownership and land use allocation

All land is owned by the Republic of Tajikistan and the Government is responsible for its effective use. The Land Code defines several forms of ownership of agricultural land. There are primary use rights and secondary use rights. Primary use rights include:

1. Continual use, which does not have a fixed term. This right is granted to legal entities such as government and agricultural cooperatives, public and religious organizations and charities, industrial and transportation needs, public enterprises, defense and joint ventures involving foreign entities.
2. 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).
3. 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 organize a Dekhan farm, as well as household (garden) plots.

Dekhan land is the result of the splitting up of large state-owned farm enterprises, known as kolkhoz and sovkhoz farms, which were established during 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 Project area is located within a Kolkhoz.** The Agrarian Reform Program in Tajikistan was adopted for the period of 2012-2020. The basis for creating Dekhan farm in the Republic of Tajikistan is defined by the Law “On Dekhan farms”⁸, №48 of 10 May 2002. In Dekhan 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. All Tajik citizens aged 18 years or above may create a dekhkan farm. Natural persons may create a dekhkan farm in groups of up to 50 people, and legal persons of any size may also create a dekhkan farm.

3.3.7 Key Acts

Constitution of the Republic of Tajikistan: The Constitution of the Republic of Tajikistan is the main legal document which guarantees citizen’s rights. Article 12 states that the economy of Tajikistan is based on various forms of ownership and the state will guarantee freedom of economic activity,

³ Constitution, November 6, 1994, as amended on 22 June 2003.

⁴ Land Code of the Republic of Tajikistan as amended on 01 August 2012

⁵ 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.

⁶ 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).

⁷ Approved by the Decree of Government of Republic of Tajikistan, December 30, 2000.№515.

⁸ Law of the RT “On Dekhan farms”.2002. www.mmk.tj



entrepreneurship, equality of rights, and the protection of all forms of ownership, including private ownership. Article 13 states that land, bowels of the earth, such as mineral resources, water, airspace, flora and fauna and other natural resources are owned by the state, and the state guarantees their effective use in the interests of the people.

The Constitution also states that the land needed for public works may be taken away only on the basis of the law, with the consent of the and with the state paying full compensation.

Land Code: In August 2012 amendments to the Land Code that enable legal sales and lease transactions for land use rights were approved.⁹ The Land Code also includes changes to the provisions related to land acquisition.¹⁰

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.

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.

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).

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, 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 recognized 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).

⁹ Law 891, dated August 2012, article 19.

¹⁰ Articles 37-45



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 favored. 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"*.

In accordance with 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.

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.

The compensation received by the Hukumat is used for the management, construction, and maintenance of local infrastructure.

Law on Pastures: The Law on Pastures (2013) defines the basic principles of pasture use, including protection of pastures and the environment, and attraction of investments for more effective use and protection of pastures. The Law specifies the powers of local administrations to control environmental safety and pasture use in accordance with state regulations and standards. The law prohibits the implementation of a number of activities in pastures, such as cutting down trees or bushes, building roads, misuse of grazing land, pollution of the environment with waste, and grazing of livestock beyond the established rate. The law requires users to ensure effective use of pastures, including protection of pastures against degradation and pollution. It provides geobotanical research on pastures to assess the potential productivity of natural forage land.

3.4 Gender Policy Framework

The Constitution of the Republic of Tajikistan recognizes international law as a component part of the national legal system and Tajikistan is a State Party to the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) and to other fundamental human rights treaties. In 2014, the Parliament ratified the Optional Protocol to CEDAW, which allows individual women in Tajikistan to submit complaints to the CEDAW Committee and gives them an additional remedy for violations of the convention. Important steps have also been taken to implement UN Security Council resolutions on women, peace, and security (1325 and 2122) with the drafting of a national action plan. The Constitution guarantees equal rights based on sex (Article 17), and principles of nondiscrimination are enshrined in basic legislation, for example, the Family Code, the Labor Code, the Land Code, the



Criminal Code, the Law on Education, and the Law on Public Health. While there are no laws that directly restrict women's rights, additional guarantees that aim to "protect" women, such as the Labor Code's night work prohibition, have nonetheless kept women from being employed in male-dominated industries.

In 2005, Tajikistan adopted the Law on State Guarantees of Equal Rights and Opportunities for Men and Women, which is the only law to define the concepts of gender and sex-based discrimination. The law prohibits discrimination based on sex, while distinguishing special measures to protect pregnancy and the health of women and men, and it guarantees equal rights in public authorities, civil service, education, labor, and the family.

The primary institution responsible for gender policy is the Committee for Women's and Family Affairs (Women's Committee), which has diverse functions ranging from conducting research to considering complaints from citizens, promoting women's rights through the media, monitoring international standards compliance, coordinating the work government and non-government bodies do on gender equality, and training. The Women's Committee operates 110 regional information-consultation and crisis centers throughout the country, funded through local budgets. A network for gender mainstreaming also links seven ministries and agencies, including the Women's Committee.

Since 2006, Tajikistan has adopted several policy documents, national programs, and strategies that support gender equality goals. A national gender policy was passed in 2010, the National Strategy for Enhancing the Role of Women in the Republic of Tajikistan, which lists concrete actions to improve women's participation in education, the labor market, entrepreneurship, and in politics, albeit without identifying responsible agencies, timeframes with milestones, funding sources, and monitoring plans. In 2013, in recognition of the seriousness of domestic violence, Tajikistan enacted the Law on the Prevention of Domestic Violence. In the same year, the Code of Administrative Offences was amended to include articles specifying liability for violation of the requirements of this legislation and for any violation of a restraining order. In addition, the State Programme for the Prevention of Domestic Violence is working to strengthen various mechanisms that have been put in place to prevent domestic violence.

3.5 Implementation and Compliance in Tajikistan

A number of legal acts establish liability for violations of environmental laws, which can be enforced by several State bodies. In particular, the 2010 Code of Administrative Violations establishes administrative liability for organizations, their officers and individuals for a range of violations, from the careless treatment of land to violation of the rules for water use or water protection or failure to comply with a State ecological expertise. The administrative sanctions for environment related violations can be imposed by the administrative commissions of *hukumats*, courts, the CEP's inspectors, the Veterinary Inspectors of the Ministry of Agriculture, and the State Committee for Land Management and Geodesy.

3.6 Environmental Permits and Licences

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 authorized 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. An indicative list of the permit types which may be required for the Project is provided in Table 9.

Table 9: Indicative List of Permits and Licenses Required for the Project

Description of Authorization 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)
Construction Stage: Permits and Licenses		
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	Committee for Environmental Protection (CEP), Tajikgeology (technical water), Ministry of Health and social defense of the population of the Republic of Tajikistan (drinking water)
Permission to cut down trees and shrubs	At the construction stage	(CEP)
Permission for emissions of harmful substances into the atmosphere (MPE) from stationary and mobile sources	At the construction stage	(CEP)
Permission for discharge of hazardous substances into water bodies (MPD)	At the construction stage	(CEP)
Permission for land acquisition for temporary storage of construction waste (substandard soil, old asphalt, dismantled concrete products, etc.)	At the construction stage	(CEP), Local authorities (Hukumats)
Permission to remove construction and household waste for storage in specially designated areas (disposal areas)	As required	Local authorities (Hukumats)

3.7 National Administrative Framework

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.

Two levels of local governments also have environmental responsibilities:

- a) Hukumat: municipality or local state administration. A chairperson appointed as a local representative of the President in the implementation national policy and administration of State services and regulations heads each Hukumat. This includes what are called Districts in this document (specifically, Roshtkala, Ishkashim, Rushnan khukumats)
- b) Jamoat: local self-government. A jamoat covers a smaller administrative area than a Hukumat and may include one or more settlements/villages. The jamoat is responsible for organizing community-based delivery of some basic public services. Jamoats have no budgeting authority and have a very limited independent role. They do have important roles under the Land Code, being responsible for allocating land and also for terminating rights to land and assigning new land.

3.8 International Agreements and Conventions

Tajikistan is a party to international environmental agreements, including those most relevant to this project:

- Vienna Convention for the Protection of the Ozone Layer, 1996, as updated
- UN Convention to Combat Desertification (CCD), 1997
- UN Convention on Biological Diversity (CBD), 1997, as updated by Cartagena and Nagoya protocols
- Ramsar Convention (joined 2000)
- Bonn Convention on the Conservation of Migratory Species of Wild Animals (joined 2001), as updated by Bukhara Deer Memorandum, 2002
- UN Framework Convention on Climate Change, 1998, with related update Kyoto Protocol, accessed on December 29, 2008, and entered into force on March 29, 2009
- Stockholm Convention on Persistent Organic Pollutants (ratified 2007), as updated
- Aarhus Convention (UNECE Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters) (joined 2001), as updated by Kiev Protocol on Pollutant Release and Transfer Registers to the Convention on Access to Information, on May 21, 2003
- Convention on International Trade in Endangered Species of Wild Fauna and Flora, 2016
- UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage (joined 1992)
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (2016)

In addition, Tajikistan has ratified a number of core labor standards of the International Labour Organisation, including the following:

- Tripartite Consultation (International Labor Standards) Convention (2014);
- Labor Inspection Convention (2009);
- Convention for the Safeguarding of the Intangible Cultural Heritage (2006);
- Convention on the Rights of the Child (CRC) (1993);
- Employment Policy Convention (1993);
- Occupational Safety and Health Convention (1981);
- Convention on the Elimination of All Forms of Discrimination Against Women (1979);
- International Covenant on Economic, Social and Cultural Rights (1976);
- Forced Labor (C029) and Abolition of Forced Labor (C105)
- Minimum Age (C138) and Worst Forms of Child Labour (C182)



- Discrimination (C111)
- Freedom of Association and the Right to Organize (C087)
- Right to Organize and Collective Bargaining (C098)
- Equal Remuneration (C100)

3.9 Regulations and Standards

Tajikistan has a comprehensive set of specific standards covering emissions, effluent discharge, noise, and waste management. The following summarises these national standards together with applicable international best practice standards. Where Tajik national standards differ from international guidelines, the more stringent standard will be applied, consistent with EBRD requirements.

3.9.1 Air Quality and Emissions

Air quality standards in Tajikistan are set by Annex 3 to the Procedure of Environmental Impact Assessment accepted by Resolution No. 464 of the Government of the Republic of Tajikistan dated 3 October 2006.

Table 10: Air Quality Standards — Tajikistan and EU Comparison

#	Parameter	Tajik Standard (mg/m ³)	Averaging Period	EU Directive 2008/50/EC (µg/m ³)	Averaging Period	More Stringent
1	PM2.5	0.16 (160 µg/m ³)	20-min MAC	25	Annual mean	EU more stringent
2	PM10	—	—	40 / 50	Annual / 24-hr	EU applies
3	NO	0.06 (60 µg/m ³)	20-min MAC	No limit value	—	Tajik applies
4	NO ₂	0.085 (85 µg/m ³)	20-min MAC	200 / 40	1-hr / Annual	Tajik more stringent (short-term)
5	SO ₂	0.5 (500 µg/m ³)	20-min MAC	350 / 125	1-hr / 24-hr	EU more stringent (24-hr)
6	CO	3.0 mg/m ³	20-min MAC	10 mg/m ³	8-hr daily max	Tajik more stringent

Project Air Quality Standards

Any air quality monitoring during the construction phase will be undertaken against the more stringent of Tajik national standards and the EU Ambient Air Quality Directive (2008/50/EC), in accordance with the EBRD's requirement to apply EU substantive environmental standards as a reference framework where these are more stringent than national provisions. Note that direct numerical comparison between Tajik MAC values and EU limit values requires care, as the two systems use different averaging periods: Tajik MACs are typically 20-minute maxima, while EU limit values are annual means or 24-hour averages. Where averaging periods differ, both standards will be monitored and reported against as applicable.

3.9.2 Water quality standards

Tajikistan sets maximum permitted concentrations (MPCs) for water quality in surface waters per Annex 3 to the Procedure of Environmental Impact Assessment accepted by Resolution No. 464 of the Government of the Republic of Tajikistan dated 3 October 2006. Tajikistan's national water quality standards are governed by the Sanitary Rules and Norms SanPiN 2.1.4.004-07 (Drinking water), SanPiN

2.1.5.980-00 (Surface water) and Hygienic Standards GN 2.1.5.689-98, along with the supplementary regulation GN 2.1.5.963a-00.

Table 11: Water Quality Standards — Tajikistan and EU Comparison

#	Parameter	Unit	Tajik Sanitary MPC	Tajik Fishery MPC	Tajik Drinking Water	EU Reference	EU Value	Notes
1	pH	—	6.5–8.5	6.0–9.0	—	WFD / Drinking Water Directive 2020/2184/EU	6.5–9.5	Tajik sanitary standard more stringent
2	BOD	mg/l	3	3.0	3	WFD (good ecological status)	No specific limit	WFD uses ecological status; Tajik MPC applies
3	COD	mg/l	—	30.0	—	WFD	No specific limit	WFD uses ecological status; Tajik fishery standard applies
4	Total Nitrogen	mg/l	10	9.1	10	Nitrates Directive 91/676/EEC	50 mg/l (nitrates as NO ₃)	Not directly comparable — different forms; Tajik MPC more stringent
5	Phosphates	mg/l	3.5	3.5	3.5	WFD Environmental Quality Standards	No single numeric limit	WFD sets basin-specific targets; Tajik MPC applies
6	Oil products	mg/l	0.3	0.1	0.1	WFD / EQS Directive 2008/105/EC	No general limit	Tajik fishery/drinking water standards apply
7	Total Suspended Solids	mg/l	25	75	25	WFD	No specific limit	Tajik sanitary standard applies
8	Total Coliform Bacteria	MPN/100 ml	500	500	0	Drinking Water Directive 2020/2184/EU	0 / 100 ml (E. coli)	Drinking water: same; surface water: Tajik applies

Note: The EU Water Framework Directive (2000/60/EC) does not set universal numerical limit values for most of the parameters above. Instead, it establishes "good ecological and chemical status" as the objective for surface water bodies, with Environmental Quality Standards (EQS) set for specific priority substances under Directive 2008/105/EC. Where the WFD does not provide an equivalent numerical standard, the Tajik MPC remains the applicable project standard.

In addition, the EU Urban Wastewater Treatment Directive (91/271/EEC) sets discharge standards for treated effluent. The following table provides these values, against which any wastewater discharge from construction camps shall also be assessed.

Table 12: EU Urban Wastewater Treatment Directive (91/271/EEC) — Indicative Discharge Standards

Parameter	Unit	EU UWWTD Standard	Averaging Basis
pH	—	Not specified	—

BOD ₅	mg/l	25	Sample or 70–90% reduction
COD	mg/l	125	Sample or 75% reduction
Total Nitrogen	mg/l	15 (10 in sensitive areas)	Annual mean
Total Phosphorus	mg/l	2 (1 in sensitive areas)	Annual mean
Oil and Grease	mg/l	Not specified	—
Total Suspended Solids	mg/l	35	Sample or 90% reduction
Total Coliform Bacteria	MPN/100 ml	Not specified (see Bathing Water Directive 2006/7/EC for recreational waters)	—

Project Water Quality Standards

Baseline water quality monitoring in rivers will be assessed against national MPCs in accordance with SanPiN 2.1.5.980-00 and the relevant fishery standards.

Project Water Discharge Standards

Wastewater discharge from construction sites and camps shall be assessed against the EU Urban Wastewater Treatment Directive (91/271/EEC) standards set out in Table 11, in accordance with the EBRD's requirement to apply EU substantive environmental standards as a reference framework. Where Tajik national discharge standards are more stringent, the national standard shall apply.

3.9.3 Noise

Tajik Standards – Tajikistan's national noise standards are regulated by the Sanitary Norms and Rules SNiP 23-03-2003 "Protection from Noise". Table 12 provides the relevant Tajik noise standards. Tajik standards refer to allowable limits both indoors and outdoors, whereas the EU Environmental Noise Directive measures noise outdoors at the most exposed façade.

EU Standards – The EU Environmental Noise Directive (2002/49/EC) uses Lden (day-evening-night equivalent level) and Lnight as its primary noise indicators, rather than a simple daytime/night-time Laeq split. The Directive does not set binding EU-wide numerical limit values; instead it establishes Lden 55 dB(A) and Lnight 45 dB(A) as recommended action thresholds for residential areas, above which member states are required to prepare noise action plans. Direct numerical comparison with Tajik or IFC Laeq standards requires care, as the indicators and time periods differ.

Table 13: Noise Standards Comparison — Tajikistan, IFC and EU END

Receptor	Tajik Daytime Laeq (07:00–16:00)	Tajik Night-time Laeq (16:00–07:00)	IFC Daytime Laeq (07:00–22:00)	IFC Night-time Laeq (22:00–07:00)	EU END Lden (action threshold)	EU END Lnight (action threshold)
Residential; institutional; educational	55 dB(A)	45 dB(A)	55 dB(A)	45 dB(A)	55 dB(A)	45 dB(A)
Industrial; commercial	70 dB(A)	70 dB(A)	70 dB(A)	70 dB(A)	No specific limit	No specific limit



Note: The EU END Lden indicator applies a +5 dB penalty to evening hours (19:00–23:00) and a +10 dB penalty to night hours (23:00–07:00). It is therefore not directly equivalent to a simple Laeq comparison. The Tajik and IFC limits are presented as Laeq values over the periods shown.

Project Noise Standards

National Tajik noise standards will be applied as the primary project noise standard, as the night-time period (16:00–07:00) provides more conservative coverage than either the IFC or EU END night-time windows. Where monitored noise levels approach the EU END Night action threshold of 45 dB(A) at residential receptors, this will also be reported. In all cases, the more stringent applicable standard shall apply.

3.9.4 Vibration

The German Standard DIN 4150-3 – Vibration in Buildings – Part 3: Effects on structures provides short term and long-term limits¹¹ for vibration at the foundation for various structures. This standard is considered international best practice and will be followed as part of the Project.

Table 14: Guideline Values for Vibration Velocity to be Used When Evaluating the Effects of Short-term and Long-term Vibration on Structures

Group	Type of structure	Guideline Values for Velocity (mm/s)				
		Short-term			Long-term	
		At foundation			Uppermost Floor	Uppermost Floor
		Less than 10 Hz	10 Hz to 50 Hz	50 to 100 Hz	All frequencies	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	10
2	Residential dwellings and buildings of similar design and/or use	5 (105 dB)	5 to 15	15 to 20	15	5 (105 dB)
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	3 (100.5 dB)	2 to 8	8 to 10	8	2.5 (99.0 dB)

Source: DIN 4150-3, Structural Vibration, Part 3: Effect of vibration on structures

DIN 4150-3 notes that “experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur. If damage nevertheless occurs, it is to be assumed that other causes are responsible. Exceeding the value in the table does not necessarily lead to damage”.

Project Vibration Standards

German Standard DIN 4150-3 will be followed during the construction phase.

¹¹ short-term vibrations are defined as those that do not occur often enough to cause structural fatigue and do not produce resonance in the structure being evaluated and long-term vibrations are all the other types of vibration.



3.10 Lender Requirements

3.10.1 EBRD E&S Policy (2024)

The Project is subject to the EBRD ESP (2024). In accordance with the Policy, the Project has been classified as Category A, reflecting the scale of works, the sensitivity of the Project area, and the potential for significant environmental and social risks and impacts if not appropriately managed. As a result, a full ESIA is required, supported by meaningful stakeholder engagement throughout Project preparation and implementation.

This ESIA assesses the Project across its full lifecycle and will address risks and impacts associated with the core Project works as well as associated facilities and activities, consistent with the EBRD's requirements for assessment, disclosure, and management of environmental and social issues.

3.10.2 Applicable Environmental and Social Requirements

Based on the nature of the Project and the findings of the Scoping Study, the EBRD ESRs listed in Table 3 are considered applicable and will be addressed in the ESIA.

Table 15: Applicable EBRD Standards

EBRD ESR	Relevance to the Project
ESR1 – Assessment and Management of Environmental and Social Impacts and Issues	Establishes requirements for the ESIA, including impact identification and assessment, application of the mitigation hierarchy, and development of environmental and social management measures across all Project phases.
ESR2 – Labour and Working Conditions	<p>Applicable to Project workers and contractor-managed labour during construction and operation, including working conditions, occupational health and safety, and worker accommodation where relevant.</p> <p>The presence of a large, predominantly male, non-local construction workforce in a remote rural setting presents a risk of gender-based violence (GBV) and sexual exploitation, abuse and harassment (SEA/H) towards women and girls in communities along the corridor. EBRD ESP (2024) requires that these risks be identified, assessed, and managed through specific prevention and response measures.</p>
ESR3 - Resource Efficiency and Pollution Prevention	Applicable to construction activities involving significant quantities of materials, fuel, water, and chemicals, and to the generation of construction waste, spoil, and wastewater. Relevant to dust and exhaust emissions, management of hazardous materials including fuels and lubricants, concrete washout, and sediment control at river crossings and drainage works.
ESR4 – Health and Safety	Addresses occupational health and safety and community health and safety risks, including traffic safety, construction-related hazards, and risks to nearby communities.
ESR5 – Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Relevant where permanent or temporary land acquisition, restrictions on land use, or livelihood impacts may occur as a result of the Project or associated facilities.
ESR6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources	Relevant due to the presence of natural and riverine habitats and the potential for impacts on biodiversity within the Project area of influence.

EBRD ESR	Relevance to the Project
ESR7 -- Indigenous Peoples	<p>ESR7 is not considered applicable to this Project. EBRD ESR7 defines indigenous peoples as distinct social and cultural groups that possess certain characteristics, including self-identification as members of a distinct indigenous cultural group; collective attachment to geographically distinct habitats or ancestral territories; customary cultural, economic, social, or political institutions separate from those of mainstream society; and an indigenous language, often different from the official language of the country.</p> <p>The communities along the BSK corridor are settled rural Tajik communities engaged in agricultural livelihoods, administratively integrated into the national governance structure of the Republic of Tajikistan, and sharing the language, cultural practices, and institutional frameworks of the wider national population. No group meeting the EBRD ESR7 definition of indigenous peoples has been identified within the Project area of influence through desktop review, consultation with PIURR, or stakeholder engagement undertaken to date.</p> <p>Should engagement identify any group that may meet the ESR7 definition, the screening determination will be revisited and the ESIA updated accordingly.</p>
ESR8 -- Cultural Heritage	<p>Relevant due to the presence of identified cultural heritage features within or adjacent to the Project corridor, including Baljuvon Fortress and community cemeteries, and the potential for discovery of previously unknown subsurface cultural material during extensive earthworks across a 56 km corridor. A chance finds procedure will be required.</p>
ESR10 – Stakeholder Engagement and Information Disclosure	<p>Requires meaningful, inclusive, and ongoing engagement with affected and interested stakeholders throughout Project preparation and implementation.</p>

3.10.3 EU Substantive Environmental Standards

In accordance with EBRD requirements, the ESIA will be informed by relevant EU substantive environmental standards, applied in principle and to the extent appropriate to the Project context. These standards provide a benchmark for good international practice and support consistency with EBRD ESRs.

Key EU standards relevant to the Project include:

- the EU Environmental Impact Assessment (EIA) Directive (2011/92/EU as amended by 2014/52/EU), which informs the approach to impact identification, alternatives analysis, cumulative impact assessment, and disclosure;
- the EU Habitats Directive (92/43/EEC) and EU Birds Directive (2009/147/EC), which inform biodiversity screening, assessment of impacts on natural habitats and species, and application of the mitigation hierarchy;
- the EU Water Framework Directive (2000/60/EC), which informs the assessment of potential impacts on surface water bodies, river crossings, drainage, and sediment management (see above 3.9.2); and
- relevant principles of the EU Environmental Noise Directive (2002/49/EC) and EU Air Quality Directive (2008/50/EC), which may be used as reference frameworks for assessing noise and air quality impacts in the vicinity of settlements (see above, 3.9.1 & 3.9.3)



Where differences exist between national legislation, EU standards, and EBRD requirements, the ESIA will apply the more stringent provisions.

3.10.4 IFC EHS Guidelines

In addition to the EBRD ESP and ESRs, the Project will be required to meet the technical performance standards set out in the relevant World Bank Group (WBG) / IFC Environmental, Health and Safety (EHS) Guidelines, including the General EHS Guidelines.

3.10.5 Human Rights

Consistent with EBRD ESP (2024) expectations for projects operating in contexts with elevated human rights risks, the ESIA has considered the applicability of a standalone human rights assessment in line with the UN Guiding Principles on Business and Human Rights (UNGPs). Given the project context — a remote rural setting, a large non-local workforce, communities with limited access to redress mechanisms, and documented vulnerabilities related to seasonal labour migration and gender inequality — human rights risks have been scoped into the assessment and are addressed throughout the ESIA, including under Section 7.13 (Labour and Working Conditions), Section 7.11 (Community Health and Safety), and Section 8 (Stakeholder Engagement). A standalone human rights assessment has not been prepared as a separate instrument; however, the key human rights risk areas identified under the UNGPs are addressed substantively within the ESIA and ESMP.

3.11 Gap Analysis: EBRD ESRs and National Legal Framework



Table **16** below provides a gap analysis between the applicable EBRD ESRs and the national legal framework of the Republic of Tajikistan at the topic and sub-requirement level. The analysis identifies where national requirements are broadly equivalent to EBRD standards, where partial equivalence exists with specific gaps, and where significant gaps require the Project to apply EBRD requirements as the more stringent standard.

Table 16: EBRD ESRs and National Legal Framework

Topic / Sub-requirement	Key EBRD Requirement	National Legislation	Gap Identified	How the Project Will Address
ESR1 – Assessment and Management of Environmental and Social Impacts and Issues				
Scope of impact assessment	Full lifecycle ESIA covering construction, operation, and decommissioning; assessment of direct, indirect, and cumulative impacts; consideration of associated facilities.	Law on Environmental Protection (2011); Law on Ecological Expertise (2012); Government Order No. 532 (2018). National EIA covers direct impacts for listed project types.	National framework does not explicitly require cumulative impact assessment, associated facility assessment, or lifecycle approach equivalent to EBRD standard.	ESIA prepared to EBRD standard, covering full project lifecycle, cumulative impacts, and associated facilities (quarries, camps, haul roads).
Alternatives analysis	Consideration of technically and financially feasible alternatives, including no-project alternative, with justification of preferred option.	No explicit requirement for alternatives analysis under national EIA procedure.	Gap: alternatives analysis not required under national law.	Alternatives analysis addressed in ESIA Chapter 4 in accordance with EBRD requirements.
Mitigation hierarchy	Application of avoidance, minimisation, mitigation, and compensation/offset hierarchy to all identified impacts.	Law on Environmental Protection requires mitigation measures but does not prescribe a formal hierarchy.	Partial equivalence: mitigation required but hierarchy not formalised in national procedure.	Mitigation hierarchy applied throughout ESIA and reflected in ESMP.
ESMP and monitoring	Environmental and Social Management Plan (ESMP) detailing mitigation measures, responsibilities, and monitoring programme.	National EIA requires environmental protection measures but no equivalent formal ESMP requirement.	Gap: no national requirement for a structured ESMP with monitoring obligations.	ESMP prepared as a standalone document to EBRD standard, with implementation responsibilities and monitoring indicators.
Public disclosure	Disclosure of ESIA to affected communities in accessible language and format prior to EBRD appraisal.	Order No. 532 (2018) requires public consultation after EIA preparation; no pre-appraisal disclosure requirement.	Partial equivalence: consultation required but timing and format differ from EBRD standard.	ESIA disclosed publicly prior to EBRD appraisal in Russian and Tajik. Non-technical summary prepared.

ESR2 – Labour and Working Conditions				
Employment terms and conditions	Written employment contracts; non-discriminatory terms; equal pay; limits on working hours; prohibition of illegal deductions.	Labour Code (2016) establishes employment contracts, non-discrimination, minimum wage, leave, and working hour limits.	Broadly equivalent. National Labour Code covers core employment rights consistent with EBRD standard.	Labour Code requirements incorporated in contractor conditions of contract. Compliance monitored through ESMP.
Child and forced labour	Prohibition of child labour (under 18 for hazardous work) and all forms of forced or compulsory labour.	Labour Code (2016) sets minimum working age at 15 (14 in limited cases); prohibits forced labour. ILO Conventions C029, C105, C138, C182 ratified.	Broadly equivalent. National law and ILO conventions consistent with EBRD requirements.	Prohibition on child and forced labour included in contractor requirements. Age verification procedures specified in Labour Management Procedure (LMP).
Occupational health and safety	OHS management system; risk assessments; PPE; accident reporting; worker training; emergency procedures.	Labour Code OHS provisions; Law on Industrial Safety of Hazardous Production Facilities (2004); Law on Fire Safety (1994); SanPiN norms.	Broadly equivalent on OHS obligations. Gap: national law does not require a formal written OHS management system or site-level OHS plan.	Contractor required to prepare and implement an OHS Plan consistent with EBRD requirements and IFC EHS Guidelines.
Worker grievance mechanism	Accessible, confidential grievance mechanism for project workers, separate from employer disciplinary process.	Labour Code provides for individual dispute resolution through courts and Labour Inspectorate. No requirement for project-level worker GRM.	Gap: no national requirement for a project-level worker grievance mechanism.	Worker GRM established as part of the LMP, covering all direct and contracted workers.
Contractor and supply chain management	Primary contractor responsible for ensuring subcontractor compliance with EBRD labour requirements; monitoring and audit obligations.	No national equivalent requirement for supply chain labour management.	Gap: no national framework for contractor labour management oversight.	Contractor requirements embedded in contract documents. ESMP includes monitoring of contractor compliance. LMP addresses contractor obligations.
GBV and SEA/H prevention and response	Identify and manage risks of gender-based violence and sexual exploitation, abuse and harassment associated with workforce influx; implement prevention measures	Law on the Prevention of Domestic Violence (2013); Law on State Guarantees of Equal Rights and Opportunities for Men and Women (2005). No specific national	Gap: national legislation addresses domestic violence and gender equality in general terms but contains no requirements for project-level	SEA/SH Plan prepared as sub-plan of ESMP. Worker Code of Conduct (CESMP-12) includes specific SEA/H prohibitions, signed by all workers prior to mobilisation. Confidential

	including a Code of Conduct, awareness training, and a confidential reporting and response mechanism.	framework for project-level GBV or SEA/H prevention in construction contexts.	SEA/H prevention plans, worker Codes of Conduct, or confidential survivor-centred reporting mechanisms.	SEA/H reporting channel established, separate from the main GRM. SEA/H awareness training mandatory for all workers. Community-facing information provided on reporting channels.
ESR3 – Resource Efficiency pollution prevention and control				
Pollution prevention and waste management	Avoid or minimise generation of waste, pollutants, and hazardous materials; manage spoil, construction waste, and liquid effluents to prevent contamination of soil, water, and air.	Law on Production and Consumption Waste (2002, amended 2011); Law on Protection of Atmospheric Air (2012); Law on Environmental Protection (2011); SanPiN norms for wastewater discharge.	Partial equivalence. National law covers waste classification and disposal and air emissions, but does not require a project-level pollution prevention plan or structured hazardous materials management system. No national equivalent to EBRD requirements for spoil characterisation or construction wastewater treatment.	Waste Management and Spoil Disposal Plan prepared as sub-plan of ESMP. Hazardous materials storage in banded compounds. Concrete washout and fuel management procedures specified in CESMP.
Hazardous materials and fuel storage	Identify, classify, and safely store all hazardous materials including fuels, lubricants, bitumen, and chemicals; prevent spills and contamination of watercourses.	Law on Industrial Safety of Hazardous Production Facilities (2004); CEP permit requirements for fuel storage.	Gap: no national requirement for secondary containment or spill response plans at construction sites.	Secondary containment required for all fuel and chemical storage. Spill response procedure included in CESMP. Emergency response plan to address accidental releases near watercourses.
Water quality and discharge	Prevent contamination of surface water and groundwater from construction activities, camp wastewater, concrete production, and in-channel works.	Water Code; SanPiN discharge norms; CEP discharge permit (MPD) requirements.	Partial equivalence. Discharge standards exist but are not consistently enforced. No national requirement for turbidity or sediment monitoring during in-channel works.	Discharge permits obtained before construction. Turbidity monitoring at all active river crossings. Camp wastewater managed through package treatment or sealed holding tanks. Concrete washout areas away from watercourses.

Air emissions and dust	Control dust and exhaust emissions from earthworks, asphalt production, and vehicle movements to protect workers and nearby communities.	Law on Protection of Atmospheric Air (2012); CEP air emission permit (MPE) requirements; SanPiN norms for ambient air quality.	Broadly equivalent. Air quality standards exist. Gap: no national requirement for a project-level dust management plan or real-time monitoring near sensitive receptors.	Dust suppression measures (water bowsters, speed limits on haul roads, stockpile management) required in CESMP. Air quality monitoring near settlements specified in ESMP monitoring plan.
ESR4 – Health and Safety				
Community health and safety management	Identification and management of construction-related risks to communities, including dust, noise, vibration, and access disruption.	SanPiN noise and air quality standards; Law on Protection of Population from Emergency Situations (2004); Health Code (2017).	Partial equivalence. Standards exist but no requirement for a formal Community Health and Safety Plan.	Community health and safety risks addressed in ESMP. Construction contractor required to implement dust, noise, and vibration controls.
Road safety	Road safety risk assessment; traffic management plan; safe passage for pedestrians and communities during construction and operation.	National road safety regulations apply. No specific requirement for a construction-phase traffic management plan or road safety action plan.	Gap: no national requirement for a project-level road safety plan during construction.	Traffic Management Plan prepared as part of CESMP. Road Safety Audit to be conducted at detailed design stage.
Emergency preparedness and response	Emergency preparedness and response plan covering construction hazards, hazardous materials spills, and natural events.	Law on Protection of Population from Emergency Situations (2004); Law on Industrial Safety (2004) require emergency preparedness.	Broadly equivalent. National law requires emergency planning. Gap: no requirement for site-specific emergency response procedures.	Emergency Response Plan included in CESMP, covering spill response, slope failure events, and worker medical emergencies.
Security personnel	Requirements for use of security personnel consistent with human rights; security management plan; Voluntary Principles on Security and Human Rights.	No equivalent national requirement.	Gap: no national framework for security personnel management in construction contexts.	Security Management Plan to be prepared if private security is engaged, consistent with EBRD requirements.
ESR5 – Land Acquisition, Restrictions on Land Use and Involuntary Resettlement				

Compensation at replacement cost	Compensation for lost land, assets, and livelihoods at full replacement cost (market value plus transaction costs), not depreciated value.	Land Code (1997, amended 2012) provides for compensation upon revocation of land use rights at market value. Civil Code (Art. 265) requires market-based assessment.	Partial equivalence. Market value required under national law but may not include transaction costs, disturbance allowances, or cost of re-establishment.	RP prepared to EBRD standard, applying replacement cost methodology. Independent valuation to be conducted.
Eligibility of informal occupants	Non-title holders, informal occupants, and those with customary rights eligible for compensation and resettlement assistance.	Land Code recognises land use rights for formal right-holders only. No provision for informal or non-titled occupants.	Significant gap: informal occupants not eligible for compensation under national law.	RP eligibility criteria extended to cover all affected persons regardless of formal title, consistent with EBRD ESR5.
Livelihood restoration	Measures to restore and improve livelihoods of economically displaced persons where income-generating assets are affected.	No national requirement for livelihood restoration programmes.	Significant gap: national law provides compensation for land loss only; no livelihood restoration obligation.	Livelihood restoration measures included in RP for economically displaced households.
No displacement before compensation	Affected persons must not be displaced or have access to assets restricted until compensation has been paid and resettlement assistance provided.	Land Code (Art. 40) requires one year's prior written notice of land revocation. No explicit prohibition on displacement before payment.	Partial equivalence. Notice required but no explicit requirement that payment precedes displacement.	RP specifies that no land access will be restricted and no physical displacement will occur until full compensation has been paid.
Resettlement Action Plan	Resettlement Action Plan (RAP) where displacement of 200 or more persons or significant livelihood impacts occur; abbreviated RAP for smaller impacts.	No national equivalent to a RAP requirement.	Gap: no national framework for preparation or implementation of a RAP.	RP prepared as a standalone instrument to EBRD standard, covering all affected persons and implementation arrangements.
ESR6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources				
Habitat classification	Classification of habitats within project area of influence as natural, modified, or critical habitat;	Law on Specially Protected Natural Territories (2011); Law on Fauna (2008); Law on Flora (2004).	Partial equivalence. National law protects designated territories and species but does not require systematic habitat	Critical Habitat Assessment (CHA) completed to EBRD ESR6 standard.

	assessment approach varies by habitat type.	Protected areas designated under national legislation.	classification using EBRD's tiered approach.	Habitat types classified and assessment conducted accordingly.
No net loss / net gain	No net loss of natural habitat; net gain required in critical habitat. No significant conversion or degradation of critical habitat unless no alternatives exist.	No national no-net-loss standard or offsetting requirement.	Gap: no national equivalent to no-net-loss or biodiversity offset requirements.	Mitigation hierarchy applied. Biodiversity Management Plan (BMP) developed to address residual impacts. Offset requirements to be determined based on CHA findings.
Protected and threatened species	Assessment of impacts on IUCN Red List species and nationally protected species; mitigation measures and monitoring.	Law on Fauna (2008); Law on Flora (2004); CITES (ratified 2016); Bonn Convention (ratified 2001); CBD (ratified 1997). National Red Data Book lists protected species.	Broadly equivalent for listed species. Gap: national framework does not require IUCN Red List assessment or quantitative population-level impact assessment.	Biodiversity baseline includes IUCN Red List species assessment. Species-specific mitigation measures included in BMP.
Invasive alien species	Prevention of introduction of invasive alien species through project activities; monitoring and control measures.	Law on Biological Security (2005) addresses biological risks; no specific invasive species management requirement for road projects.	Gap: no national requirement for invasive species management plans in road construction.	Invasive species risk identified in ESIA. CESMP includes provisions for equipment cleaning and monitoring of weed spread.
Ecosystem services	Assessment of impacts on ecosystem services on which affected communities depend.	No national requirement for ecosystem services assessment.	Gap: ecosystem services assessment not required under national framework.	Ecosystem services considered qualitatively in ESIA in relation to river systems, pasture land, and community water sources.
ESR10 – Stakeholder Engagement and Information Disclosure				
Timing and continuity of engagement	Meaningful engagement initiated early in project preparation and continued throughout implementation; not limited to post-EIA consultation.	Order No. 532 (2018) requires public consultation after preparation of EIA materials; no requirement for early or ongoing engagement.	Significant gap: national requirement limited to a single post-EIA consultation event.	SEP prepared and engagement initiated during Scoping stage. Ongoing engagement planned throughout ESIA preparation and construction.

Stakeholder Engagement Plan	Written SEP identifying stakeholders, engagement methods, timeline, and resources; disclosed prior to EBRD appraisal.	No national equivalent to an SEP requirement.	Gap: no national requirement for a formal SEP.	SEP prepared as a standalone document to EBRD standard and disclosed publicly.
Vulnerable and disadvantaged groups	Identification of and tailored engagement with vulnerable groups (women, elderly, disabled, minority groups) who may face barriers to participation.	Aarhus Convention (ratified 2001) supports public participation rights; Law on State Guarantees of Equal Rights for Men and Women (2005). No specific requirement for targeted engagement with vulnerable groups.	Gap: no national requirement for differentiated engagement with vulnerable groups in EIA process.	SEP identifies vulnerable groups in the project area and includes tailored engagement measures. Gender-sensitive consultation methods applied.
External grievance redress mechanism	Accessible, transparent, and culturally appropriate GRM for external stakeholders; timely response commitments; records maintained.	Law on Appeals of Individuals and Legal Entities (2016) sets 15–30 day response timeframes. National GRM through Jamoats and courts. No project-level GRM required.	Partial equivalence. National appeals process exists but lacks project-specific accessibility, confidentiality, and non-judicial character required by EBRD.	Project-level GRM established and described in SEP. GRM accessible at community level via Jamoat offices and dedicated contact points.
Information disclosure	Timely disclosure of project information in local language(s) and accessible formats; non-technical summary of ESIA.	Law on Environmental Information (2011) establishes right of access to environmental information. Order No. 532 requires disclosure of EIA materials for consultation.	Broadly equivalent on right to information. Gap: no requirement for non-technical summary or disclosure prior to appraisal.	Non-technical summary of ESIA prepared in Russian and Tajik and disclosed publicly. ESIA disclosed to EBRD and on PIURR website prior to appraisal.

4. Analysis of Alternatives

4.1. Overview of Alternatives

This section presents the analysis of alternatives undertaken in connection with the BSK Project, in accordance with EBRD ESR1. For each category of alternative considered, the rationale for the preferred option is set out and its environmental and social implications are identified. Given the nature of the Project as the rehabilitation and upgrade of an existing road corridor in steep mountainous terrain with limited valley width, the range of genuinely feasible alternatives is constrained. The analysis focuses on those alternatives where meaningful choices existed and where the decision has material environmental or social consequences. The principal alternatives considered are:

- (a) without-project scenario;
- (b) route and corridor alternatives;
- (c) design standard and level of intervention;
- (d) construction technology alternatives — slope and riverbank protection;
- (e) construction technology alternatives — bridge structures; and
- (f) alternatives to avoid and minimise land acquisition and resettlement impacts.

4.2. Without Project Scenario

Under the without-project scenario, the BSK road would remain an unsurfaced earth and gravel track passable only by four-wheel drive vehicles, with no pavement, no adequate drainage infrastructure, and no formal road surface at all beyond km 36. Current conditions — minimum curve radii below 20 m, maximum gradients exceeding 12–15%, and vehicles navigating the Shurobdaryo bed from km 36 to km 56 — represent functional failure of the infrastructure as a permanent transport connection rather than merely poor road quality.

The consequences of this scenario are significant and well documented. The approximately 6,000 residents of the 11 villages directly served by the road, and the wider population of approximately 30,000 in the Baljuvon district, would continue to experience seasonal isolation and constrained access to health facilities, markets, administrative services, and educational opportunities, particularly during winter months and periods of heavy rainfall. The 31.2 km distance between Baljuvon and Shahidon, currently requiring more than two hours by four-wheel drive vehicle, would remain unchanged. Agricultural produce — the primary livelihood source along the corridor — would continue to be consumed locally or discarded due to the absence of reliable market access. Exposure to road safety risks on a substandard unprotected track would continue for all users.

The without-project scenario does not address existing transport deficiencies, does not support the socio-economic development objectives identified for the Project area, and would perpetuate conditions of infrastructure failure and community isolation. It is not considered a viable alternative and is retained for comparative purposes only.

4.3. Route and Corridor Alternatives

A formal route selection process was undertaken during the feasibility and preliminary design stages, resulting in a Route Selection Act for each section that documented the evaluation of alignment options and formed the basis for the preferred alignment. The process drew on topographic and



geodetic surveys covering a corridor of at least 120 m width along the full route, field inspection of the existing road surface and structures, geotechnical and hydrological investigations, and assessment of settlement patterns, land use, and natural hazard exposure.

Section 1 (km 0–20.1)

Section 1 connects the settlements of Khorm, Doshmandi, Chilitori, Darcsikilko, Bogi Zogon, and Toidara. For the majority of this section, the preferred alignment follows the right bank of the Shurobdaryo, making maximum use of the existing road corridor which had been partially reconstructed to Category V standard up to approximately km 9. The valley topography in this section — steep slopes on both sides, a narrow valley floor, and the river occupying much of the available flat land — leaves limited scope for significantly different alignments. A left bank alternative would require multiple additional river crossings, would pass through areas of greater slope instability on the southern valley side, and would fail to connect the settlements located on the right bank, which are the primary beneficiaries of the road.

Within the preferred right bank corridor, the alignment has been optimised to follow the existing roadbed with maximum reuse of the existing subgrade, using minimum cutting and small embankments. Berms of 1–2 m width have been incorporated on cut sections throughout to intercept falling rocks and soil before they reach the carriageway or drainage structures — a design response directly informed by the pattern of rockfall and slope erosion documented in the geotechnical survey (Kocks, 2023). In the vicinity of Toidara, where residential buildings and boundary fences have been constructed directly at the roadside, the alignment has been constrained by existing development and the design has had to accommodate the settlement footprint within very limited corridor width, with enhanced local safety measures.

Section 2 (km 20.1–56.3)

Section 2 presents a fundamentally different alignment challenge. From approximately km 32.6 to km 56.3, no formal road has ever existed and vehicles currently travel across both the left and right banks of the Shurobdaryo depending on river levels and seasonal conditions. The alignment in this section is therefore substantially new rather than a rehabilitation of an existing route, and required genuine evaluation of corridor options across the upper valley.

The preferred alignment follows the right bank of the Shurobdaryo for the majority of Section 2, running along slopes and away from the river floodplain wherever terrain permits, in accordance with the Route Selection Act. This choice was driven by several factors. The right bank offers more stable slope conditions across much of the upper section compared to the left bank. The right bank also provides direct access to the majority of settlements served by the road in the upper corridor — including Darcsa (km 35), Nusay (km 40), Shomush (km 43), Shipdara (km 44), Peshtova (km 46), Shikeldara (km 50), and Mullokoni (km 52) — avoiding the need for additional crossing structures to reach these communities. A left bank alignment would have required significantly more river crossings, greater exposure to flood and scour risk in the more active lower flood channel and would have bypassed the communities that the road is intended to serve.

At the transition between Sections 1 and 2 near Chilitori, a new bridge connects the right and left banks, reflecting a specific alignment decision at the section boundary where terrain and settlement access required a crossing. In the area around km 30.6–32.0, the alignment passes close to a settlement containing a helicopter landing pad, which is to be demolished as part of the project, and subsequently routes between a honey processing facility (affecting 15m² of land – see section on Land Use for further details) and a new bridge at the Langar cemetery. The Langar cemetery crossing was identified as an unavoidable constraint — the alignment passes through the cemetery at this location — and was agreed through consultation with the local administration (APZ) as part of the route selection process – however no graves are affected. Connecting roads to the centre of the Shahidon



jamoat were incorporated into the alignment at this location in response to community connectivity requirements identified during engagement.

General approach to localised refinements

Across both sections, the preferred alignment was developed with the objective of maximising reuse of existing disturbed areas and the historical road corridor, while incorporating localised deviations where required by terrain, natural hazard exposure, settlement impacts, or cultural heritage constraints. The specific refinements introduced include deviations to reduce road platform exposure to active landslide and mudflow zones identified in the Project geotechnical survey (Kocks, 2023), alignment adjustments to avoid or minimise impacts on residential structures and community infrastructure, cultural heritage avoidance measures including the cemetery crossing agreement noted above, and geometric improvements in constrained sections to achieve minimum safety standards for sight distance and curve radius.

Compared to the development of a new corridor on either bank, the approach of maximising use of the existing alignment and its historical corridor limits overall land take, reduces disturbance to undisturbed slopes and riverbanks, reduces construction cost and complexity given the very remote terrain of the upper section, and maintains connectivity to settlements along the established route. A wholly new corridor was not considered technically or environmentally justified given that a viable valley route is available and that the upper section, while currently without a formal road, already has an established pattern of vehicle movement that defines the only practical corridor through the terrain.

Where further alignment optimisation has been identified as necessary during detailed design — particularly in areas of active slope instability or where detailed survey revealed additional community or environmental sensitivities — this has been addressed through the mitigation hierarchy, with avoidance the preferred first response.

4.4. Design Standards and Level of Intervention

The road is designed to Technical Category V standard. This represents a meaningful choice between two realistic options.

The alternative of Category IV standard was considered during the feasibility phase. Category IV would imply a higher design speed (60 km/h flat terrain, 40 km/h mountain), wider carriageway and subgrade dimensions, higher design probability for hydraulic structures (bridges designed to 2% flood probability rather than 1%), and correspondingly greater land take, earthworks volumes, and construction cost. Sections of the existing road were originally designed or partially constructed to Category IV parameters.

Category V was selected as the preferred standard on the following grounds. Current traffic intensity is low at approximately 10–20 vehicles per day, and even with projected annual growth of approximately 10%, traffic volumes over the design period do not justify the capacity implied by Category IV. The mountainous terrain of the corridor — steep valley sides, narrow valley floor, active natural hazards — means that the additional width and geometric requirements of Category IV would require significantly greater earthworks, more extensive slope cutting, larger land take, and increased disturbance to riverbanks and sensitive slopes, with commensurate environmental and social costs. Category V is proportionate to the functional role of the road as a local and district connector. The design incorporates enhanced parameters at specific locations — including settlement areas and bridge crossings — where terrain or safety considerations require it.

A lower level of intervention — partial maintenance or surface improvement only, without full pavement construction, drainage, slope protection, and bridge rehabilitation — was also considered and rejected. The existing road's condition is so severely deficient, particularly in the upper 20 km where no formal road exists at all, that partial intervention would not achieve reliable year-round



access or adequate road safety and would not be cost-effective relative to the long-term maintenance burden it would generate.

4.5. Slope and Riverbed Protection

For slope protection and riverbank protection, gabion mattresses, Reno mattresses, and flexible gabion retaining structures were selected over rigid concrete alternatives. This choice is technically justified by several factors specific to the BSK corridor, and is supported by observable evidence of the performance of existing protection works along the route.

The most direct evidence comes from the existing condition of the road. Concrete slab bank protection structures installed in earlier works along sections of the Shurobdaryo floodplain have been destroyed by flood events. This failure of rigid concrete protection under the hydraulic conditions of the corridor — high-velocity flows, significant sediment and boulder transport, and active lateral channel movement — provides direct empirical grounds for preferring flexible solutions on the upgraded road. The Shurobdaryo carries large volumes of coarse material including boulders exceeding 70 cm in diameter during high-flow events, generating impact loads that rigid concrete structures cannot absorb without cracking and progressive failure.

Gabion and Reno mattress structures offer several technical advantages in this specific context. Their flexibility allows them to accommodate differential settlement and ground movement, which is particularly important along a corridor characterised by active landslides, mudflows, and unstable slopes — conditions where rigid foundations cannot be guaranteed. Gabion structures dissipate hydraulic energy through their permeable, rough surface rather than deflecting it, reducing scour at the toe of protection works. Where the river flow impinges directly on the protection, concrete cubes of 1×1×1 m and large stones of over 70 cm diameter are specified at the most hydraulically stressed locations in front of spurs, providing additional impact resistance while retaining overall system flexibility. Angular quarried stone is specified for gabion fill in preference to rounded river gravel — which the ESMP notes is predominantly unsuitable for gabion fill given its tendency to displace under load — ensuring better interlocking and structural performance.

From a maintenance and climate resilience perspective, gabion systems present further advantages over rigid concrete in this setting. Concrete protection works are vulnerable to thermal cracking under the extreme temperature range projected for the corridor — with peak temperatures potentially exceeding 50°C in the riverbed under climate change scenarios — and to progressive deterioration where freeze-thaw cycles act on cracked surfaces at higher elevations. Gabion mesh, while subject to abrasion and corrosion from increased sediment loads under projected climate conditions, can be repaired incrementally using locally available stone without specialist equipment or materials, which is critical given the remoteness of the upper corridor. A damaged concrete protection section requires concrete batching capacity and skilled formwork — neither reliably available in a remote mountain setting — whereas a damaged gabion section requires stone, wire, and unskilled labour, all of which can be sourced locally.

The use of geotextile filters beneath all protection structures is a further element of the design that reflects the specific conditions of the corridor. Without geotextile backing, fine-grained silty soils — present at multiple locations along the alignment — would migrate through gabion voids under hydraulic pressure, undermining the protection structure from behind. The geotextile layer prevents this while allowing drainage, addressing a failure mode that has affected unlined protection works along similar mountain river corridors in the region.

4.6. Bridge Structure Alternatives

The bridge type selection process evaluated multiple structural options against criteria including functionality, safety, structural integrity, economic feasibility, durability, constructability in the specific project setting, and compatibility with the seismic and environmental conditions of the



corridor. Span length was the primary geometric criterion driving type selection, given that most bridge types can accommodate a range of deck widths.

For the three short-span bridges of approximately 19 m (Bridges 1, 2, 3, 6, and 10), rigid reinforced concrete box girder structures were selected. This type — a single monolithic unit of top slab, bottom slab, and side walls — requires no expansion joints or support elements, is simpler to form and construct than alternatives, and offers lower overall construction cost. Prefabricated beam alternatives and monolithic slab alternatives were considered for this span range but rejected on cost and constructability grounds, the box girder structure being clearly preferable in both respects.

For the medium-span bridges ranging from approximately 24 m to 33 m (Bridges 4, 5, 7, 8, and 9, with spans up to 4×33 m), the principal choice was between monolithic in-situ reinforced concrete slab construction and prefabricated prestressed reinforced concrete beam construction. Both are standard solutions for this span range in regional highway practice.

The prefabricated beam option offers certain advantages under normal conditions — beams manufactured off-site in controlled factory conditions address quality assurance concerns, installation by mobile crane reduces the working space required under the bridge, and the approach is widely used for medium-span bridges regionally. However, it was rejected for this project on the following specific grounds.

First, logistics and constructability. Precast prestressed beams for spans of 24–33 m are large, heavy elements that must be manufactured at a reinforced concrete products facility and transported to site. At the time of construction, the road does not yet exist beyond km 36 — vehicles currently travel in the riverbed — and the existing track in the lower sections is a narrow earth road unsuitable for heavy abnormal loads. The transport of precast beam elements to bridge locations in the upper corridor, particularly Bridges 7, 8, and 9 located between km 43 and km 52, would require either completing the road before the bridges — which is impractical given the sequence of works — or using specialist heavy transport on terrain wholly unsuited to it. The logistical risk and cost of this approach in a remote mountain setting with no access infrastructure was judged to be prohibitive.

Second, seismic performance. The entire project corridor lies within an 8-point seismic zone as defined by the seismic zoning map of the Republic of Tajikistan, with soil category II at construction sites. This is a high seismic hazard rating. Monolithic in-situ construction produces a continuous, fully integrated structure without the joints and bearing interfaces inherent in prefabricated beam construction. In seismic events, these interfaces are points of vulnerability — beams can be displaced from their bearings under lateral loading, a failure mode responsible for bridge collapses in seismically active regions worldwide. Monolithic construction eliminates this vulnerability by creating a single structural unit that distributes seismic forces across the whole frame.

Third, the specific hydrological conditions at bridge crossings reinforce the case for monolithic construction. Several crossings — particularly Bridges 4 and 7, near Shahidon and Peshtova respectively, with catchment areas exhibiting high debris flow potential — are exposed to significant boulder and debris impact loading during flood events. Monolithic structures have greater inherent resistance to impact and dynamic loading than assembled prefabricated systems, where individual beam-bearing connections represent the weakest points under sudden load.

The in-situ approach does carry a disadvantage — it requires formwork installation at each bridge location and concrete pouring in situ, which demands scaffolding, shuttering, and sufficient working space beneath the bridge deck. For spans up to 30 m this is a manageable constraint; for the 33 m spans used in the larger bridges, variable structural thickness in the slab design has been used to manage deflection. These construction requirements have been reflected in the construction programme and site logistics planning.

4.7. Alternatives to Avoid and Minimise Land Acquisition and Resettlement Impacts

In accordance with EBRD ESR5, the mitigation hierarchy requires that involuntary resettlement and land acquisition be avoided where feasible, minimised where avoidance is not possible, and mitigated through compensation and livelihood restoration where residual impacts remain. This section documents the measures taken to apply this hierarchy during the design of the BSK Project.

Approach to avoidance

The primary instrument for avoiding land acquisition and resettlement impacts was alignment optimisation — designing the road to follow the existing road corridor and historically disturbed areas as closely as possible, and introducing localised deviations where terrain, safety, or social constraints required. The overall preference for following the existing alignment rather than developing a new corridor was itself an avoidance measure: the existing track, however poor in condition, occupies land that has already been disturbed and in most sections runs through areas with established clearance from settlement cores. A new corridor would have required opening undisturbed land and potentially crossing settlement areas that the existing track avoids.

Within the preferred corridor, the detailed measurement survey and census process identified all land parcels, structures, and assets within the right-of-way. Where possible, the design team worked with the Social Safeguards specialists and the Design Institute (DITI) to identify adjustments to the alignment or cross-section that could reduce or eliminate impacts on individual parcels. In sections of populated areas and private land, the longitudinal and transverse profiles were specifically designed to minimise occupation of private land, using small embankments and minimal cutting of the existing road to reduce the width of the required right-of-way footprint. A berm of 1–2 m was introduced on cut sections throughout Section 1 for structural and safety reasons — catching falling rock and soil — but was kept as narrow as terrain allowed to limit land take on the slope side.

Outcome of the avoidance process

The alignment refinement process achieved a significant avoidance outcome: no residential houses are affected by the proposed road project. Despite the alignment passing through or immediately adjacent to settlement areas at multiple locations — including Toidara, where residential buildings and fences have historically been constructed directly at the roadside, and Shahidon and Mullokoni where the road passes through settlement areas — the finalised right-of-way does not require the demolition or physical displacement of any residential structure along the full 56 km corridor. This outcome reflects the sustained effort applied during design to keep the road formation within the minimum required width in populated sections.

Residual impacts that could not be avoided

Notwithstanding the avoidance measures applied, land acquisition and economic displacement could not be fully avoided, as road standards were required to be maintained to ensure safe access and reliable transport. The residual impacts that remain after all practicable avoidance measures were applied are summarised below. Precise figures will be confirmed in the updated RP, which is being finalised in parallel with this ESIA and should be read alongside it.

A total of 116 land parcels are affected across the corridor, comprising privately used parcels and public or state-managed parcels. In all cases impacts are partial — no parcel is fully acquired. Affected land types include residential, commercial, Dehkan farm, and rented state forestry land parcels. A total of 99 affected households are identified.

Structures affected are limited to supplementary structures including fences and gates, which will be shifted and reconstructed slightly further from the road edge on the same land parcel. No structure will be demolished before the affected person has received full cash compensation, collected salvage materials, and vacated the affected area. A total of 3,080 trees are affected across the corridor,



comprising fruit trees and saplings and non-fruit trees and saplings. A power line running along parts of the route will be relocated during the construction phase.

Two community cemeteries — cemetery Shulash and cemetery (Mazor) Langar — are partially within the right-of-way. No graves are located within the proposed right-of-way. The boundary fencing of Shulash and the metal gate and stone wall of Langar will be demolished and reconstructed outside the ROW edge. These arrangements were agreed with the relevant local authorities and Jamoats, who have been notified of the ROW boundaries to ensure no new graves are placed within the alignment corridor. The Langar cemetery crossing was discussed and agreed with the local administration (APZ) as part of the route selection process, as documented in the Route Selection Act for Section 2.

The land acquisition and resettlement outcome of the BSK Project reflects a sustained application of the avoidance and minimisation hierarchy during design. The most significant avoidance achievement is the absence of any physical displacement of residential structures across the full corridor length. Residual impacts — partial land take, tree and crop loss, fence and gate relocation, and two cemetery boundary adjustments — are addressed through the RP compensation and livelihood restoration framework, prepared in accordance with EBRD ESR5. All compensation will be paid in full before construction commences on any affected parcel.

4.8. Summary

The alternatives analysis presented in this section demonstrates that the preferred BSK Project option — rehabilitation of the existing alignment to Category V standard, using in-situ concrete bridge structures, flexible gabion riverbank and slope protection, and a right bank corridor for the majority of both sections — represents a technically sound, environmentally proportionate, and socially justified response to the transport and connectivity needs of the Baljuvon district.

The without-project scenario was rejected as not viable. It would perpetuate functional failure of the transport connection serving approximately 6,000 corridor residents and 30,000 district inhabitants, with no prospect of improvement to road safety, seasonal access, or livelihood connectivity.

The preferred alignment maximises reuse of the existing disturbed corridor, limiting land take and disturbance to undisturbed slopes, riverbanks, and natural habitats compared to any new corridor alternative. The right bank preference for both sections is justified by slope stability, settlement connectivity, and the avoidance of additional river crossings. Localised refinements throughout both sections have successfully eliminated physical displacement of residential structures — the primary social avoidance objective of the alignment design process.

Category V design standard is proportionate to current and projected traffic volumes and minimises earthworks, land take, and environmental disturbance relative to Category IV. A lower level of intervention was rejected as insufficient to achieve year-round reliable access or adequate road safety on a corridor where infrastructure has effectively failed in the upper section.

Gabion and Reno mattress protection systems are preferred over rigid concrete on the basis of demonstrated failure of concrete slab protection along the corridor, the dynamic and high-energy nature of the Shurobdaryo system, the need for flexible structures that can accommodate ground movement in an active natural hazard environment, and the practical requirements of maintenance in a remote mountain setting. In-situ monolithic bridge construction is preferred over precast alternatives on grounds of logistics in an access-constrained corridor, seismic performance in an 8-point zone, and resilience to debris flow impact loading at key crossings.

Land acquisition and resettlement impacts have been reduced to the minimum achievable consistent with maintaining required road standards. No residential structures are displaced. Residual impacts — partial land take, tree and crop loss, relocation of fences and gates, and two cemetery boundary adjustments — are managed through the RP in accordance with EBRD ESR5.

Table 17 below provides a summary of the alternatives considered and the basis for selection of the preferred option in each case.

Table 17: Summary of Alternatives Analysis

Alternative Category	Options Considered	Preferred Option	Key Environmental and Biodiversity Considerations	Principal Basis for Selection
Without-project	Do nothing / maintain as-is	Rejected	Continued uncontrolled erosion, riverbank degradation, and vehicle movements in active river channel would perpetuate ongoing habitat damage with no mitigation.	Infrastructure failure; community isolation; no safety improvement.
Corridor	Right bank vs left bank; new corridor vs existing alignment	Right bank, existing alignment maximised	Maximises reuse of existing disturbed corridor; avoids opening undisturbed slopes and riverbanks; reduces total habitat disturbance relative to new corridor. Left bank rejected partly due to greater slope instability and higher biodiversity sensitivity in riparian zones.	Slope stability; settlement connectivity; limited additional crossings; reduced land take.
Design standard	Category IV vs Category V; full rehabilitation vs partial intervention	Category V, full rehabilitation	Category V minimises earthworks, land take, and slope disturbance relative to Category IV. Partial intervention rejected as insufficient, but would have generated uncontrolled ongoing erosion with no mitigation.	Proportionate to traffic; reduced earthworks and land take; partial intervention insufficient.
Slope and riverbank protection	Rigid concrete vs flexible gabion / Reno mattress	Gabion / Reno mattress	Gabion systems allow natural substrate to remain partially accessible to aquatic fauna at bank edges; concrete creates hard impermeable barriers. Gabion failure mode is gradual rather than catastrophic, reducing risk of sudden habitat disturbance during flood events.	Demonstrated failure of concrete; high-energy dynamic river system; maintenance in remote setting; climate resilience.
Bridge superstructure	Precast prestressed beams vs monolithic in-situ RC	Monolithic in-situ RC	In-situ construction eliminates need to transport heavy precast elements through sensitive riparian corridor. Dry season working window restriction applies equally to both options.	Logistics in access-constrained corridor; seismic performance in 8-point zone; debris flow resilience.
Land acquisition and resettlement	New corridor vs existing alignment; full vs minimum ROW width	Existing alignment; minimum ROW width in populated sections	Minimum ROW approach directly reduces permanent habitat loss. No physical displacement means no resettlement outside the corridor into undisturbed areas.	No physical displacement of residential structures achieved; land take minimised.

5. Methodology

5.1. Scoping of Impacts

A formal scoping exercise was undertaken prior to this ESIA, as documented in the ESIA Scoping Study (2026). The scoping process identified the environmental and social topics requiring detailed assessment, those requiring focused assessment, and those scoped out on the basis of low likelihood of significant impact. Topics were evaluated against criteria including baseline sensitivity, magnitude and spatial extent of potential impacts, likelihood of occurrence, duration and reversibility, and regulatory and lender requirements. The outcomes of the scoping exercise, including the rationale for each decision and the relevant EBRD ESR, are presented at the opening of Section 7 and informed the structure and focus of the impact assessment presented therein.

5.2. Assessment Boundaries

The environmental and social area of influence (AOI) varies by topic, reflecting the nature and spatial extent of potential impacts associated with each discipline. Table 18 sets out the defined AOI for each environmental and social topic assessed in the ESIA, together with the rationale for the boundary selected. The AOIs have been defined with reference to the nature of Project activities, baseline environmental and social conditions along the corridor, applicable EBRD ESR guidance, and recognised international technical standards where relevant.

All associated facilities — including construction camps, borrow areas, spoil disposal sites, asphalt and aggregate processing facilities, and temporary access tracks — are treated as part of the Project footprint for the purposes of AOI definition.

Table 18: Environmental and Social Areas of Influence by Topic

Environmental / Social Topic	Area of Influence (AOI)	Rationale
Climate change and natural hazards	Full Project corridor plus a 500 m lateral buffer; wider regional context considered qualitatively.	The corridor is exposed to multiple natural hazard processes — landslides, mudflows, debris flows, rockfall, flooding, and snow-related hazards — driven by steep slopes, complex geology, river incision, and seasonal snowmelt. Hazard sources affecting the road can originate from slopes and catchments beyond the immediate corridor. A 500 m buffer captures the principal contributing catchments and slope failure zones while a regional context review addresses macro-level climate projections.
Topography, geology and soils	Within 50m including areas of cut-and-fill earthworks, spoil disposal sites, borrow areas, and temporary works areas.	Physical disturbance is confined to the COI and associated works areas. Road widening of 1–2 m on either side is the principal land disturbance activity; deeper cut-and-fill and spoil management areas extend this footprint locally. Baseline geology indicates high sensitivity to physical disturbance across the corridor, with shallow colluvial and aleuritic soils prone to loss of strength when saturated. The AOI encompasses all areas of permanent and temporary ground disturbance.
Water resources and hydrology (surface water)	Full length of the Shurobdaryo corridor within the Project area; 500 m downstream of each river crossing and drainage discharge point.	The road alignment follows the Shurobdaryo valley for an extended length and crosses numerous tributary streams. The river exhibits active lateral migration, bank scour, and high sediment and debris transport, and has historically caused repeated damage to road embankments during peak-flow events. Drainage discharges, culvert outfalls, and bridge construction

Environmental / Social Topic	Area of Influence (AOI)	Rationale
		have the potential to affect water quality and geomorphology downstream of construction works. A 500 m downstream buffer captures the zone likely to be affected by construction-phase sedimentation and post-construction changes in drainage.
Water resources and hydrology (groundwater)	Within 100 m of work zones, fuel storage areas, camp sites, borrow areas, and ancillary facilities.	Groundwater users are present within and adjacent to settlements along the corridor. Potential impacts are associated with infiltration of spills, leaks, and hazardous liquids from construction activities and fuel storage. Beyond 100 m, dilution and attenuation in unsaturated and saturated soils reduce the likelihood of significant groundwater quality impacts. Groundwater impacts are expected to be limited to the immediate vicinity of work zones and storage areas where source proximity is greatest.
Air quality (construction)	350 m from the boundary of all active work zones, including construction camps, borrow areas, asphalt plant sites, and ancillary facilities.	Construction earthworks, material handling, haulage on unpaved surfaces, and aggregate processing at borrow and asphalt plant locations will generate dust and combustion emissions. The 350 m boundary is consistent with the screening guidance of the UK Institute of Air Quality Management (IAQM) for construction dust assessment, within which human receptors may be exposed to dust levels warranting detailed assessment. Settlements are present along the corridor within this distance in multiple locations.
Air quality (operation)	Screened out — no defined AOI required.	Forecast traffic volumes are low for a rural mountain road, with no expectation of sustained congestion or queuing. The open, well-ventilated corridor provides good dispersion conditions and no dense built-up street canyon effects exist. No air-quality-sensitive receptors are sited immediately adjacent to the road in a configuration likely to result in exceedances of applicable standards. Operational air quality impacts will be confirmed qualitatively in the ESIA.
Noise and vibration (construction) — noise	500 m from the edge of active work zones, construction camps, and ancillary facilities.	The baseline noise environment along the corridor is generally quiet, reflecting the rural and mountainous setting. Settlements and noise-sensitive receptors (residential dwellings, schools, community facilities) are present in close proximity to the alignment in multiple locations. The 500 m AOI captures all noise-sensitive receptors likely to experience construction noise above ambient levels and is consistent with the separation distance at which construction noise levels are expected to fall below 55 dB(A) LAeq under typical conditions.
Noise and vibration (construction) — vibration	50 m from active excavation, compaction, blasting, and demolition operations.	Road rehabilitation works will involve mechanical excavation, vibratory compaction, and potentially controlled blasting in rock cut sections. Vibration from these activities has the potential to cause disturbance and minor structural damage to buildings in close proximity. Beyond 50 m, vibration amplitudes from the types of plant and methods anticipated (mechanical excavation, compaction, controlled blasting) are expected to fall below levels of structural concern or perceptible disturbance for most receptor types. Site-

Environmental / Social Topic	Area of Influence (AOI)	Rationale
		specific assessment will be undertaken at individual sensitive locations.
Noise (operation)	100 m from the road edge on each side.	Improved road condition and increased traffic flows following rehabilitation will increase operational noise levels at roadside receptors. At typical traffic volumes anticipated for the BSK corridor, noise levels are expected to fall below 55 dB(A) LAeq at distances beyond approximately 100 m, taking into account the screening effect of topography, vegetation, and front-row properties. The 100 m AOI captures the zone within which operational noise may represent a material change from baseline conditions.
Biodiversity — habitats	100 m from the edge of the ROW and all temporary works areas (construction compounds, borrow areas, access tracks, spoil disposal sites).	The corridor encompasses a mosaic of modified and semi-natural habitats, with higher-sensitivity riparian and riverine habitats associated with the Shurobdaryo and its tributaries. Physical disturbance, edge effects, dust deposition, and changes in hydrology during construction may affect habitats beyond the immediate works footprint. A 100 m buffer captures the zone in which direct and indirect habitat disturbance is most likely, while also encompassing buffer zones relevant to assessment under EBRD ESR6.
Biodiversity — fauna	200 m from the edge of the ROW and temporary works areas; haul routes assessed individually.	Construction disturbance including noise, vibration, artificial lighting, and human activity may displace or disrupt fauna across a wider area than the physical works footprint. River corridors associated with the Shurobdaryo system may provide important movement routes for wildlife, including species associated with the Sari Khosor Nature Park area at the upper end of the corridor. A 200 m AOI represents a precautionary approach consistent with available guidance on construction disturbance and wildlife displacement.
Protected areas (Sari Khosor Nature Park)	Within 5 km of the Nature Park boundary for direct and indirect effects; wider regional context for access-related pressures.	The Project does not intersect the Sari Khosor Nature Park, but the road terminus at Sari Khosor is located in close proximity to the Park boundary. Improved road access will reduce travel times to the area and may increase visitor numbers, agricultural activity, and other human pressures within and around the Park. A 5 km AOI captures the principal zone of influence for indirect access-related effects, while a broader regional assessment addresses cumulative pressures.
Aquatic ecosystems	500 m upstream and 1 km downstream of each watercourse crossing and drainage outfall; the full Shurobdaryo corridor within the Project area.	In-stream construction works at bridge and culvert crossings, together with drainage discharges and surface runoff from earthworks, have the potential to increase turbidity, suspend sediment, and affect water quality in adjacent watercourses. Fish and aquatic invertebrates are sensitive to changes in water quality and physical habitat during construction. The asymmetric AOI (shorter upstream, longer downstream) reflects the directional transport of sediment and contaminants in flowing water. The full Shurobdaryo corridor is included given the river's high sediment transport capacity and active geomorphological behaviour.

Environmental / Social Topic	Area of Influence (AOI)	Rationale
Land acquisition and land use	As defined in the Project RP: full COI, temporary works areas, borrow areas, and ancillary facility footprints.	Land acquisition impacts are limited to areas within the permanent and temporary works footprint. The RP identifies affected parcels of agricultural, dehkan, and forestry land, as well as areas of public land subject to temporary occupation. The AOI for land acquisition follows the RP boundary, which has been defined through cadastral survey, field verification, and detailed design information. Where design is not yet finalised, a precautionary works envelope has been applied.
Livelihoods	Households and land users with land or productive assets within the RP boundary; wider community of affected persons identified through socioeconomic surveys.	Livelihoods in the Project area are predominantly land-based, with high dependence on dehkan farming, livestock grazing, forestry land use, and tree crops. Livelihood impacts are most directly associated with loss of productive assets within the works footprint, but may also extend to land users whose access to more distant parcels is temporarily disrupted during construction. The AOI encompasses all households identified through RP preparation as experiencing livelihood impacts, including those with partial land loss, loss of trees or crops, or temporary access restrictions.
Vulnerable groups	All communities within the Project area of influence as defined by the social assessment, with targeted assessment of households identified as vulnerable through RP and SEP processes.	The RP and socioeconomic baseline identify multiple categories of vulnerable household along the corridor, including those with limited landholdings, female-headed households, elderly-headed households, and households with disabled members. High dependence on land-based livelihoods means that even partial land loss may result in disproportionate impacts on these groups. The AOI for vulnerable groups is therefore defined broadly to capture all communities within reach of Project impacts, with targeted assessment applied at the household level for identified vulnerable individuals.
Community health and safety	200 m from the edge of the ROW and all active work zones; communities adjacent to haul routes, construction camps, and access roads used by project vehicles.	The road passes through and in close proximity to multiple settlements, with known baseline road safety concerns. Community health and safety risks during construction include accidents involving construction vehicles, exposure to open excavations, dust and emissions, and restricted access to properties and community facilities. During operation, risks relate principally to increased traffic volumes and speeds on the improved road surface. A 200 m AOI captures the zone of highest risk around work areas, consistent with guidance on community safety management in linear infrastructure projects.
Labour and working conditions	All work zones, construction camps, batch plants, borrow areas, and ancillary facilities where project workers are present.	Occupational health and safety risks are confined to areas where workers are present. The AOI encompasses the full Project works footprint plus all associated facilities used by the contractor workforce during construction, including temporary camps and material processing areas. For assessment of labour influx and community interface risks, the AOI extends to communities within daily travel distance of construction camps (see also Gender-based Violence / SEA-SH).
Cultural heritage —	100 m from the edge of the ROW and all temporary works	Known cultural heritage sites, including cemeteries identified in close proximity to the alignment, are

Environmental / Social Topic	Area of Influence (AOI)	Rationale
known sites (cemeteries and structures)	areas; individual assessment of known sites based on specific location and setting.	individually assessed with reference to their specific location and sensitivity. A 100 m buffer captures the zone within which construction activities (vehicle movement, vibration, dust, workers) could directly affect known cultural heritage assets. Sites beyond this distance are unlikely to experience physical impacts from construction and are not within the zone of visual or setting sensitivity for the types of infrastructure involved.
Cultural heritage — archaeology and chance finds	Full COI and all areas of ground disturbance, including borrow pits, spoil disposal sites, and access track construction areas.	The Project area has a long history of human settlement, and planned earthworks across the full length of the corridor create potential for the discovery of previously unidentified subsurface archaeological material. The AOI for chance finds encompasses all areas of ground disturbance, consistent with the spatial extent of the earthworks programme. A Chance Find Procedure will be embedded in the ESMP and applied across all work areas.
Traffic and transport	Full Project road corridor; haul routes and access roads used during construction; communities whose sole road access passes through active construction zones.	Construction activities will generate additional heavy vehicle movements on the Project road and access routes, potentially causing congestion, damage to carriageway surfaces, and temporary disruption to access for communities along the corridor. The improved road will also generate long-term changes in traffic patterns and safety conditions during operation. The AOI encompasses the full corridor and construction access network, with particular attention to settlements where access could be restricted during construction.
Waste management	Within work zones, construction camps, and ancillary facilities; within 50 m of designated spoil disposal and waste storage areas.	Construction waste generation, including excavated material, pavement waste, hazardous materials, and domestic waste from work camps, is confined to active work areas and associated storage and disposal sites. Beyond 50 m of waste storage and disposal areas, the risk of direct environmental contamination from waste is low. All waste streams will be managed in accordance with the ESMP and applicable regulatory requirements, including licensed disposal routes for hazardous materials.
Cumulative impacts	The broader Shurobdaryo and Kyzylsu river valleys and the Sari Khosor area; regional assessment of combined effects with other planned or foreseeable development activities.	Improved access along the BSK corridor may act as a catalyst for increased agricultural intensification, tourism development, and other land use change in the Project area and in the Sari Khosor area at the upper end of the route. The cumulative AOI is defined broadly to capture combined effects of the Project with other reasonably foreseeable activities, including other infrastructure investments in the Khatlon Region, agricultural development, and increased visitor pressure on environmentally sensitive areas.
Gender-based violence / SEA-SH	Communities within approximately 15–20 km of construction camps and active work areas, encompassing all settlements along the road	The presence of a contractor workforce at construction camps creates risks of gender-based violence, sexual exploitation and abuse (SEA), and sexual harassment (SH) in communities within daily travel distance of work areas. The 15–20 km AOI reflects a precautionary approach consistent with EBRD guidance on SEA/SH risk

Environmental / Social Topic	Area of Influence (AOI)	Rationale
	corridor and in adjacent accessible valleys.	management in linear infrastructure projects, where workforce mobility means that community-level risks may extend beyond the immediate vicinity of construction sites. A dedicated SEA/SH Action Plan will be prepared as part of the Project ESMP.

5.3. ESIA Methodology

The ESIA has been prepared in accordance with the requirements of EBRD Environmental and Social Requirement 1 (ESR1) and applicable EBRD ESRs, Tajik national environmental legislation and EIA requirements, and international good practice as defined by the International Finance Corporation (IFC) Performance Standards and associated Environmental, Health and Safety (EHS) Guidelines. The methodology follows a structured, risk-based approach that integrates environmental and social considerations across all stages of analysis, from scoping through to impact assessment, mitigation design, and residual impact evaluation.

The ESIA applies the mitigation hierarchy as its organising principle for impact management. This requires that potential adverse impacts are first avoided where feasible through design choices; where avoidance is not possible, impacts are minimised or reduced to the lowest practicable level; residual impacts are then mitigated through targeted management measures; and where significant residual impacts remain after mitigation, compensation or offset measures are considered where technically and financially feasible. This hierarchy has informed both the alternatives assessment presented in Chapter 4 and the impact assessment and mitigation chapters that follow.

5.3.1. Desktop Data Review

The baseline characterisation and impact assessment draw on a comprehensive review of published and unpublished secondary data collected from national and international sources. Desktop data sources used in the preparation of the ESIA include:

- national and regional climate data, including historical meteorological records and available climate change projections for the Khatlon Region and wider Tajikistan;
- topographic, geological, and geotechnical data, including existing geological mapping, geomorphological surveys, and geotechnical investigation reports prepared for the Project;
- hydrological and hydraulic data, including river flow records for the Shurobdaryo system and existing hydrological assessments;
- national and regional biodiversity databases, protected area designations, and available species records, including data from the Sari Khosor Nature Park administration and national biodiversity inventories;
- land use and cadastral data, including information provided by the district land administration authorities and material compiled during RP preparation;
- socioeconomic and demographic data from national statistical sources and the Project socioeconomic baseline surveys;
- cultural heritage registers, including data from the relevant national heritage protection authority and prior heritage assessments in the Project area;
- the Project Initial Environmental Examination (IEE), feasibility study reports, and preliminary engineering design documentation; and
- applicable EBRD ESRs, IFC EHS Guidelines, World Health Organization (WHO) standards, and other relevant international technical guidance.

References to all data sources are provided throughout the relevant sections of the ESIA report and in the reference list. Where data gaps or limitations have been identified, these are noted explicitly in the relevant baseline sections, and their implications for the confidence of impact predictions are addressed in the impact assessment.

5.3.2. Site Surveys and Baseline Monitoring

Site surveys and instrumental baseline monitoring were conducted by the ESIA team during 2026 to characterise environmental and social conditions along the BSK road corridor and at key receptor locations. Surveys were undertaken at representative locations across the full length of the corridor, with targeted investigations at locations identified as environmentally or socially sensitive during the scoping phase.

Site survey activities were constrained in some locations by terrain conditions and access limitations arising from the current state of the road. Where direct access to specific sections was not possible, observations were made from adjacent accessible areas and supplemented by remote sensing data and aerial photography. Safety restrictions were observed throughout all field activities. Table 19 summarises the principal survey and monitoring activities undertaken as part of ESIA baseline characterisation.

Table 19: Baseline Site Surveys and Monitoring Activities

Survey / Activity	Period	Coverage
General site survey and social reconnaissance	January to April 2026	BSK road corridor (full length)
Biodiversity survey (habitats, flora, fauna)	March & April 2026	BSK road corridor; riparian and hillside habitats; proximity to Sari Khosor Nature Park
Instrumental monitoring — noise	July 2023 / April 2026	Representative roadside locations adjacent to settlements
Instrumental monitoring — air quality (dust/PM)	July 2023 / April 2026	Selected locations near active earthworks and settlements
Instrumental monitoring — surface water quality	July 2023 / April 2026	Shurobdaryo and principal tributary crossings
Social surveys and household interviews	March 2026	Affected settlements along the corridor; vulnerable household sampling

Detailed descriptions of the survey methodologies, monitoring equipment, sampling protocols, and quality assurance procedures applied during each baseline investigation are provided in Annex B to this report. The outcomes of each survey are summarised in the relevant baseline sections of Chapter 6 and inform the impact predictions presented in Chapter 7.

5.4. Impact Assessment Methodology

The impact assessment methodology applied in this ESIA follows a structured, stepwise process designed to identify, characterise, and evaluate potential environmental and social impacts in a systematic and transparent manner. The principal steps in the methodology are described below.

Step 1 — Identification of Project Aspects and Activities: Project aspects — those activities, physical changes, or operational conditions that have the potential to interact with the environment or communities — are identified for each phase of the Project lifecycle (pre-construction, construction, and operation and maintenance). This includes both direct activities within the works footprint and indirect effects arising from associated facilities, traffic generation, access changes, and induced development.

Step 2 — Identification of Receptors: Environmental and social receptors that may be affected by Project aspects are identified for each topic. Receptors include physical environmental features (watercourses, soils, air quality), ecological features (habitats, species, ecological connectivity), and social receptors (communities, households, land users, cultural heritage assets, and vulnerable groups). Receptors are characterised with reference to their baseline condition and inherent sensitivity, drawing on the baseline data collected as described in Section 5.3.1 and 5.3.2 above.

Step 3 — Impact Characterisation: For each combination of Project aspect and receptor, the nature of the potential interaction is described, including the causal pathway through which the impact may occur. Impacts may be direct (resulting from physical works or operational activities acting directly on a receptor), indirect (resulting from secondary changes triggered by the Project), or cumulative (resulting from the combination of Project impacts with other existing or reasonably foreseeable activities). Positive impacts, including connectivity, safety, and access benefits, are characterised alongside adverse impacts.

Step 4 — Impact Significance Assessment: The significance of each predicted impact is evaluated prior to the application of specific mitigation measures (pre-mitigation significance), using the criteria described in Table 20 below. Significance is expressed as negligible, minor, moderate, major, or critical for adverse impacts, and as minor, moderate, or major for positive impacts. The significance assessment reflects professional judgement informed by baseline sensitivity, impact magnitude, and the strength of available evidence.

Table 20: Impact Significance Assessment Criteria

Criterion	Description
Magnitude	The scale and severity of the predicted change relative to baseline conditions. Magnitude is assessed as high, medium, low, or negligible, taking into account the physical extent of change, the degree of deviation from baseline, and whether the change is reversible. For social impacts, magnitude also reflects the degree of disruption to livelihoods, access, community cohesion, or cultural practices.
Spatial scale	The geographic extent over which the impact is predicted to occur, ranging from site-specific (confined to the immediate works area) to local (affecting the surrounding community or ecosystem), sub-regional (affecting a broader valley or catchment), or regional.
Duration and reversibility	The time period over which the impact is expected to persist (short-term during construction, medium-term during early operation, or long-term and permanent) and whether the affected environment or community can reasonably recover following the cessation of the causal activity. Irreversible long-term impacts of high magnitude attract the highest significance ratings.
Probability of occurrence	The likelihood that the predicted impact will materialise, particularly for risks dependent on specific meteorological, hydrological, or operational conditions. Probability is considered alongside consequence in determining overall risk significance.
Sensitivity of the receptor	The vulnerability or importance of the environmental or social receptor that may be affected. Sensitivity is assessed with reference to international and national designations, ecological rarity, legal protection, community dependence, and socio-economic vulnerability. High-sensitivity receptors include EBRD-designated critical habitat features, legally protected species, communities with high land-based livelihood dependence, and vulnerable households.

The combination of receptor sensitivity and impact magnitude is used to determine significance using a structured assessment matrix, which is set out in full in Annex C (ESIA Methodology). The matrix provides a consistent and replicable framework for significance determination across all topics, while allowing for professional judgement in individual cases where the standard matrix outcome does not adequately reflect the specific characteristics of an impact.

Step 5 — Mitigation Measure Identification: For each impact assessed as minor significance or above, mitigation measures are identified following the mitigation hierarchy. Measures are developed with reference to applicable EBRD ESR requirements and IFC EHS Guidelines, as well as good international industry practice for road rehabilitation projects in mountainous terrain. Mitigation measures are described in sufficient detail to inform the preparation of the Environmental and Social Management Plan (ESMP) and associated topic-specific management plans.



Step 6 — Residual Impact Assessment: Following the identification of mitigation measures, the significance of each impact is reassessed to determine the residual significance — that is, the significance of the impact that would remain after the proposed mitigation has been implemented. Residual impacts of moderate significance or above trigger the identification of additional or enhanced mitigation, or — where residual significance cannot be reduced to acceptable levels — compensation or offset measures. Residual impacts are reported transparently in the impact assessment tables in Chapter 7.

Impacts assessed in the ESIA are characterised as positive or negative, reversible or irreversible, temporary or permanent, and direct, indirect, or cumulative, consistent with ESR1 requirements and international good practice guidance on ESIA methodology. Transboundary impacts are considered qualitatively where relevant, although no material transboundary impacts have been identified for this Project given its geographic setting and the localised nature of the principal environmental and social risks.

The full impact assessment methodology, including detailed definitions of all significance criteria, the significance rating matrix, and worked examples of the application of the methodology, is provided in Annex C.

5.5. Stakeholder Engagement

Stakeholder engagement has been conducted throughout the development of the Project and the preparation of the ESIA, consistent with the requirements of EBRD ESR10 (Information Disclosure and Stakeholder Engagement) and applicable Tajik national consultation requirements. Engagement has been designed to ensure open, transparent, and two-way communication with all interested parties and potentially affected persons throughout the Project lifecycle.

The approach to engagement for the Project is defined in the Stakeholder Engagement Plan (SEP), which sets out the identification and classification of stakeholder groups, the methods and timing of engagement activities, and the mechanisms for receiving, recording, and responding to stakeholder feedback. The SEP has been prepared as a standalone document and is subject to ongoing review and updating as the Project progresses.

Engagement activities undertaken to date as part of ESIA preparation have included:

- initial community consultations in settlements along the corridor to introduce the Project, explain the ESIA process, and gather local knowledge of environmental and social conditions;
- targeted consultations with affected land users and households identified in the RP process to discuss land acquisition procedures, compensation entitlements, and livelihood restoration measures;
- meetings with national and regional authorities, including district administrations, environmental regulatory agencies, and the road authority, to present Project proposals and obtain institutional input;
- consultation with the Sari Khosor Nature Park administration to discuss the potential for indirect access-related impacts on the Park and surrounding environment; and
- disclosure of the draft ESIA Scoping Report for public comment, with review of comments received incorporated into the preparation of this ESIA.

All engagement activities are documented in the Project Stakeholder Engagement Register, which records the date, location, participants, issues raised, and responses provided for each engagement event. A summary of stakeholder engagement findings relevant to each ESIA topic is provided in the relevant sections of Chapter 8, and a consolidated account of engagement activities and outcomes is presented in the Project SEP.

The following principles govern all stakeholder engagement activities undertaken for this Project:

- information disclosed to stakeholders is accurate, complete, and accessible, and does not create undue expectations or disproportionate concerns with respect to potential Project impacts;
- engagement materials are provided in Tajik and Russian where required, and in a format and language accessible to all segments of the affected community, including those with low literacy levels or who are unfamiliar with formal environmental assessment processes;
- engagement is conducted in a culturally appropriate manner, with specific attention to the needs and preferences of vulnerable groups, including women, elderly persons, and persons with disabilities; and
- all stakeholder inputs, including concerns and objections, are recorded and given due consideration in the preparation of the ESIA and the development of mitigation and management measures, with responses communicated back to stakeholders in a timely manner.

Further community consultation, including disclosure of the draft ESIA, will be conducted prior to Project implementation in accordance with the SEP and EBRD disclosure requirements. The Project Grievance Mechanism, described in the SEP, provides an ongoing channel for communities and individuals to raise concerns or complaints throughout construction and operation.

6. Baseline Conditions

This chapter presents the environmental and social baseline conditions of the Project area. The baseline characterises the existing state of the physical, ecological, and social environment within and around the BSK road corridor, drawing on desktop data sources, published national and regional datasets, and the results of site surveys and instrumental monitoring undertaken by the ESIA team during 2026, as described in Chapter 5.

The baseline provides the reference point against which potential Project impacts are assessed in Chapter 7. Where baseline conditions are inherently dynamic — particularly with respect to climate parameters, river behaviour, and slope processes — the temporal dimension of baseline change is noted. Uncertainty in baseline characterisation, including data gaps identified during desktop review or field investigations, is acknowledged explicitly throughout this chapter.

The chapter is organised by environmental and social topic, broadly consistent with the ESIA topic structure used in the impact assessment. For each topic, the baseline description addresses the geographic scope relevant to the topic, the sensitivity or quality of available data, and the principal implications for impact prediction.

6.1. Physical Environment

The Project area occupies a transitional zone between the lower foothills of the western Pamir-Alay mountain system and the broader Khatlon lowlands, and is characterised by a continental mountain climate with pronounced seasonal contrasts and significant spatial variability along the approximately 56 km corridor length.

The regional climate is governed by the interplay of continental air masses from Central Asia and orographic effects associated with the surrounding mountain ranges. Altitude and valley orientation are the dominant controls on local climate conditions, producing marked differences in temperature, precipitation, humidity, and snow accumulation between lower valley sections near Baljuvon and the higher-elevation reaches approaching the end point of the alignment. These spatial gradients are important for understanding the distribution of climate-related hazards along the corridor.

Tajikistan as a whole is considered one of the most climate-vulnerable countries in Central Asia due to its mountain geography. The country is highly sensitive to climate variability and climate change because of its glacier-dependent river systems and exposure to natural hazards such as landslides,

debris flows, and floods. According to national assessments and the UNEP Environmental Atlas of Tajikistan (2025), rising temperatures, changes in precipitation patterns, and accelerated glacier retreat are already influencing hydrological regimes and increasing the frequency and intensity of climate-related hazards in mountainous regions. The Khatlon Region and adjacent mountain zones are already experiencing measurable changes in temperature and precipitation patterns relative to mid-twentieth century baselines. Changes in temperature and precipitation may therefore influence vegetation patterns, water availability, and ecosystem functioning in mountainous regions such as the BSK corridor.

6.1.1. Temperature

Observed climate trends in Tajikistan indicate a clear warming pattern over recent decades, with national average temperatures increasing since the mid-20th century. Climate projections for Central Asia suggest continued warming throughout the 21st century, with modelling under intermediate and high-emission scenarios projecting average temperature increases exceeding 4°C by mid-century and maximum daily temperatures potentially surpassing 50°C in low-elevation sections of the corridor. These projections have material implications for water resources, infrastructure durability, natural hazard dynamics, and road maintenance requirements.

Temperature data for the BSK corridor is available from three meteorological stations relevant to different sections of the alignment. The Baljuvon station (altitude 800 m above sea level), at the lower end of the corridor, records an average annual air temperature of +11.2°C, an absolute maximum of +41°C, and an absolute minimum of -30°C. Monthly mean temperatures range from -1.1°C in January to +23.0°C in July. The Hovaling station (altitude 1,463 m), located on the right bank and representative of mid-corridor conditions, records an average annual temperature of +10.8°C, an absolute maximum of +39°C, and an absolute minimum of -30°C. Monthly means range from -3.2°C in January to +23.6°C in July. The Kangurt station (left bank, lower elevation), which is broadly representative of the lower and transitional sections of the corridor, records a higher average annual temperature of +14.3°C, reflecting its lower elevation and more sheltered position, with an absolute maximum of +45°C and an absolute minimum of -25°C. Monthly means at Kangurt range from approximately 0°C in January to +27.6°C in July.

Taken together, these station records confirm the strong seasonal temperature regime along the corridor and the marked elevation-dependent variation. Summer temperatures at lower elevations regularly approach or exceed 40°C under extreme conditions, while winter minima fall to -25°C to -30°C across much of the corridor. At upper-corridor elevations approaching 2,000–2,500 m, conditions are considerably colder in winter and cooler in summer than the station records suggest, consistent with the standard orographic lapse rate.

The winter–spring transition period — typically February to April across the corridor — is characterised by fluctuating temperatures around the freezing point. This produces active freeze-thaw cycling that plays an important role in slope weathering, soil destabilisation, and progressive deterioration of road surfaces and protection structures. The Baljuvon station records an average annual soil freezing depth of 12 cm with a design frost depth of 0.9 m, while the Hovaling and Kangurt stations record shallower frost penetration of 15 cm and 10 cm respectively, reflecting local soil and exposure conditions. Extended frost periods at mid- to upper-corridor elevations contribute to seasonal snow accumulation and spring snowmelt-driven peak flows.

Table 21: Mean Monthly Air Temperatures at Meteorological Stations Relevant to the BSK Corridor (°C)

Station	Altitude (m asl)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
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Baljuvon	800	-1.1	+1.0	+6.0	+12.0	+16.0	+21.0	+23.0	+22.0	+17.0	+11.0	+6.0	+1.0	+11.2
Hoaling	1,463	-3.2	-0.9	+4.9	+10.9	+15.8	+19.8	+23.6	+22.7	+17.7	+11.5	+5.9	+1.3	+10.8
Kangurt	~500	0.0	+3.1	+8.4	+14.3	+18.9	+23.9	+27.6	+26.4	+21.5	+14.6	+8.6	+3.8	+14.3

Source: Feasibility Study, Rehabilitation of the BSK Highway, June 2025 (Sections 3.7 and 4.2.1). Absolute maxima: Baljuvon +41°C, Hoaling +39°C, Kangurt +45°C. Absolute minima: Baljuvon -30°C, Hoaling -30°C, Kangurt -25°C.

6.1.2. Precipitation

Precipitation in the Project area is moderate in annual terms but highly seasonal in its distribution, with the timing and intensity of rainfall and snowfall events having significant implications for natural hazard processes and infrastructure performance. Available regional meteorological data indicate average annual precipitation ranging from approximately 525 mm in the lower valley sections to 842 mm at mid-corridor elevations, with the highest values associated with elevated sections of the alignment.

Precipitation is concentrated in the spring months, with March typically recording the highest monthly totals. The spring peak reflects the convergence of frontal rainfall systems and the onset of snowmelt at higher elevations, producing conditions that are particularly conducive to runoff generation, slope instability, and elevated river discharge. A secondary precipitation maximum may occur in winter, associated with frontal systems and snowfall at higher elevations.

Summer months are relatively dry, with lower precipitation totals and a shift towards convective, high-intensity rainfall events. Although summer precipitation totals are lower than spring values, intense convective storms can generate rapid runoff, flash flooding in tributary channels, and debris flow initiation on steep slopes. The combination of dry antecedent conditions and intense rainfall can be particularly effective in producing concentrated runoff from slopes with limited infiltration capacity.

Snowfall and snow cover represent an important component of the precipitation regime at mid- to upper-corridor elevations. Average maximum snow depths of approximately 20–30 cm are recorded in lower and mid-elevation sections, rising to approximately 50–60 cm or more at higher elevations. Recorded maximum snow depths can exceed these averages in exceptional years. Snow cover persists for variable periods through winter and into spring, with snowmelt contributing substantially to spring runoff and river discharge volumes.

Relative humidity exhibits a seasonal pattern consistent with precipitation seasonality. Values are highest during winter and spring, generally exceeding 70%, and decrease markedly during summer to approximately 30–40%. These humidity conditions influence evapotranspiration rates, soil moisture, and the availability of water for slope processes.

Table 22: Summary of Key Observed Climate Parameters for the BSK Corridor Area

Parameter	Observed Value / Range	Source / Notes
Mean annual precipitation	525–842 mm/yr	Lower values at Baljuvon (800 m asl: 525–582 mm); mid-corridor at Kangurt (693 mm) and Hoaling (1,463 m asl: 842 mm). Higher values associated with increased elevation
Peak precipitation month	March	Consistent across all three stations; spring snowmelt amplifies runoff generation during this period

Parameter	Observed Value / Range	Source / Notes
Mean annual air temperature	+10.8°C (Hovaling); +11.2°C (Baljuvon); +14.3°C (Kangurt)	Kangurt's higher value reflects lower elevation and more sheltered position
Absolute maximum temperature	+39°C (Hovaling); +41°C (Baljuvon); +45°C (Kangurt)	Peak summer temperatures in lower valley sections can approach or exceed 40°C
Absolute minimum temperature	-30°C (Hovaling and Baljuvon); -25°C (Kangurt)	Frost conditions prevalent across the corridor in winter
Relative humidity — winter/spring	73–74% (March–January peak)	Highest during snowmelt season; consistent across stations
Relative humidity — summer	33–36% (August)	Dry season conditions; consistent across stations
Average maximum snow depth	21–32 cm (Kangurt and Hovaling); 26–36 cm maximum (Baljuvon)	Recorded maxima: 34 cm (Kangurt), 60 cm (Hovaling)
Soil frost depth	10 cm (Kangurt); 12 cm average / 0.9 m design depth (Baljuvon); 15 cm (Hovaling)	Design frost depth of 0.9 m applied at Baljuvon

Source: Feasibility Study, Rehabilitation of the BSK Highway, June 2025 (Sections 3.7 and 4.2.1); Initial Environmental Examination, BSK Road, March 2025 (Section 4, Climate).

6.1.3. Wind

Wind conditions in the Project area are influenced by valley topography and the diurnal heating and cooling of mountain slopes. Valley winds — characterised by upslope flows during daytime and downslope drainage winds at night — are typical of the mountain valley setting of the BSK corridor. These local wind patterns are relevant to the dispersion of dust and exhaust emissions from construction activities and to wind-driven soil erosion on disturbed surfaces.

Wind data for the corridor are available from the Hovaling and Kangurt meteorological stations. At Hovaling (1,463 m asl), prevailing winds are from the north, northeast, and southwest, with an average annual speed of 2.8 m/s. At Kangurt (lower left bank), prevailing winds are from the northeast and south, with a lower average annual speed of 1.4 m/s, reflecting the more sheltered position of this station within the valley. The difference in average wind speeds between the two stations is consistent with the greater exposure of the mid-corridor Hovaling station to valley channelling effects and frontal systems.

Maximum wind speeds at recurrence intervals relevant to infrastructure design are summarised in below.

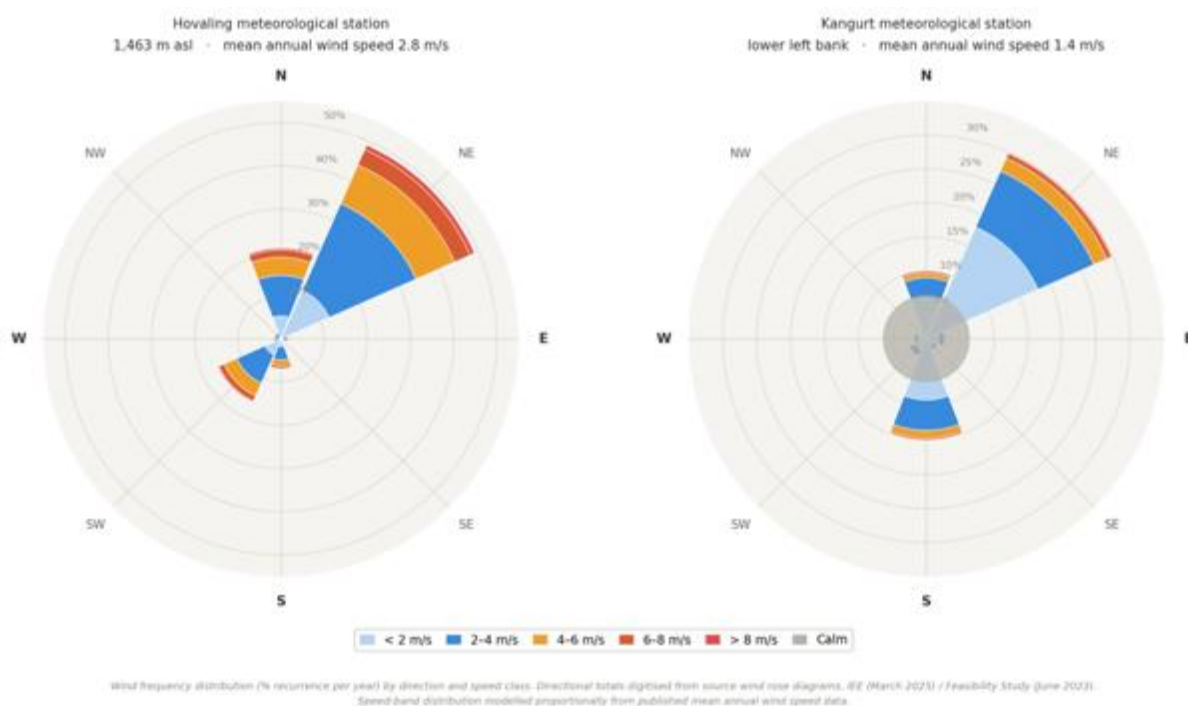
Table 23: Maximum Wind Speeds at Meteorological Stations Relevant to the BSK Corridor

Station	1-year (m/s)	5-year (m/s)	10-year (m/s)	15-year (m/s)	20-year (m/s)
Hovaling (1,463 m asl)	16	19	20	21	22
Kangurt (lower left bank)	13	17	19	20	21

Source: Feasibility Study, Rehabilitation of the BSK Highway, June 2025; Initial Environmental Examination, March 2025.

Extreme wind speeds, while moderate relative to open plateau areas of Central Asia, are sufficient to mobilise fine construction dust from exposed earthworks and spoil areas, particularly during dry summer conditions. Channelling effects within narrow valley sections can locally amplify wind speeds beyond the station averages. Seasonal wind patterns are characterised by stronger and more variable winds during spring and early summer, associated with the passage of frontal systems, coinciding with the period of greatest precipitation and slope instability risk. Wind rose diagrams for both stations, showing the frequency distribution of wind direction, are reproduced below.

Figure 12: Wind Roses



6.1.4. Historical Climate Trends

Tajikistan is among the countries of Central Asia most exposed to climate-related natural hazards. Analysis of observed hazard data for the period 1980–2020 (World Bank 2021) indicates that floods and landslides are the most frequent climate-related hazards affecting the country, with floods accounting for the majority of recorded economic losses. Droughts and floods are ranked highest in the INFORM Risk Index for Tajikistan, which classifies the country as a medium risk country overall, though with high sensitivity in mountainous and glacier-dependent areas.

The project area lies within the Khatlon Region, which is characterised by inherently high exposure to hydrometeorological hazards due to steep terrain, active river systems, and seasonally concentrated precipitation. Road infrastructure in this region has historically suffered repeated damage from flooding, slope failures, and debris flows, and the BSK corridor itself shows clear evidence of this exposure — sections of the existing embankment protection have been destroyed by past flood events, and the road is periodically impassable during winter and spring.

Observed long-term temperature trends for Tajikistan are consistent with the broader Central Asian warming signal documented in the global instrumental record. National and regional studies indicate that mean annual temperatures in Tajikistan have increased measurably since the mid-twentieth century, contributing to observed changes in glacial extent in the upper Amu Darya basin, shifts in snowmelt timing, and increases in the frequency of extreme heat events. These trends are reflected in the WorldClim baseline dataset (1970–2000) used in the CRA for this Project, which records current monthly maximum temperatures in the project area ranging between 8°C and 32°C, and monthly

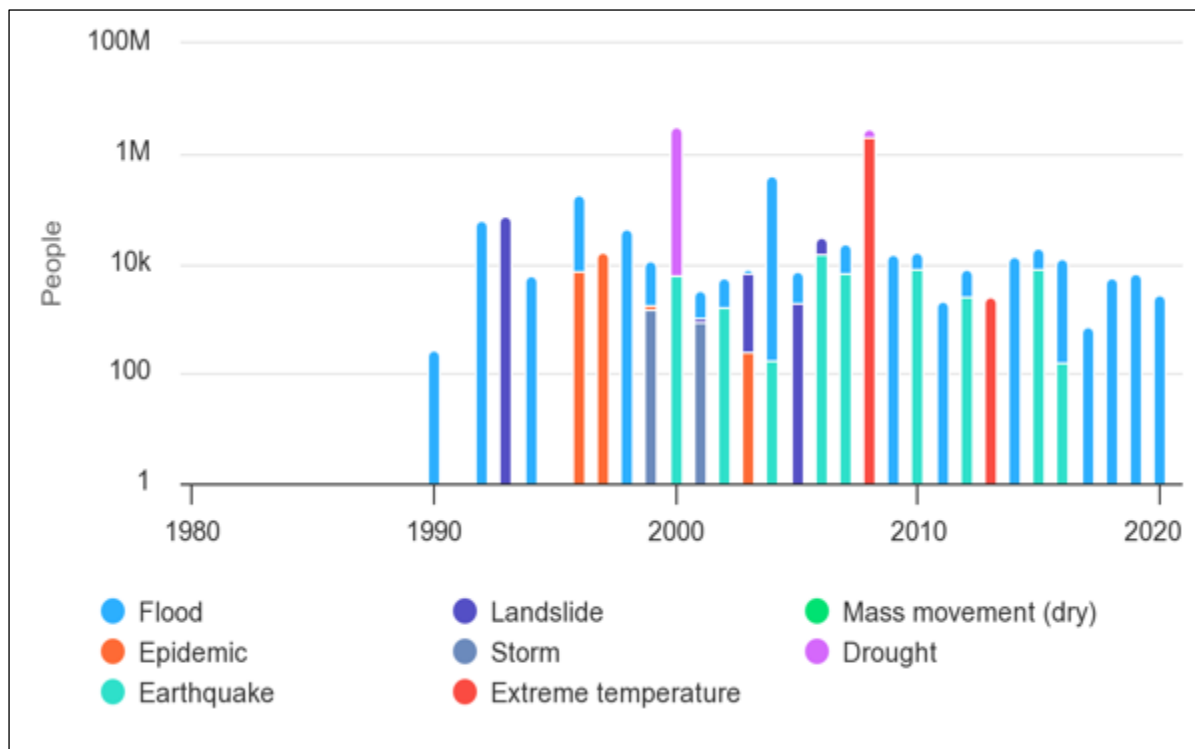
minimum temperatures between -10°C and 10°C — values that represent the tail end of a period of already-changing climate conditions rather than a stable pre-industrial baseline.

6.1.5. Natural Hazards

Regional hazard context

The BSK corridor is located in the Khatlon Region of Tajikistan, a mountainous area with inherently high exposure to natural hazards. Analysis of observed hazard events across Tajikistan for the period 1980–2020 confirms that floods and landslides are the most frequent and economically significant hazards nationally, with approximately 36% of the country's land area at risk from landslides and mudslides.¹² In 2006 alone, approximately 13,000 people were affected by flooding and landslide events in Tajikistan.¹³ The country's road network — which carries over 85% of all freight and passenger traffic — is the primary infrastructure asset exposed to these hazards, and the Khatlon Region has historically experienced repeated road damage from flooding, slope failures, and debris flows. Based on the INFORM Risk Index, Tajikistan is classified as a medium risk country overall, with droughts and floods ranked as the highest hazard categories, and floods accounting for the majority of recorded economic losses.¹⁴

Figure 13. Number of affected people by key natural hazard in Tajikistan for 1980-2020



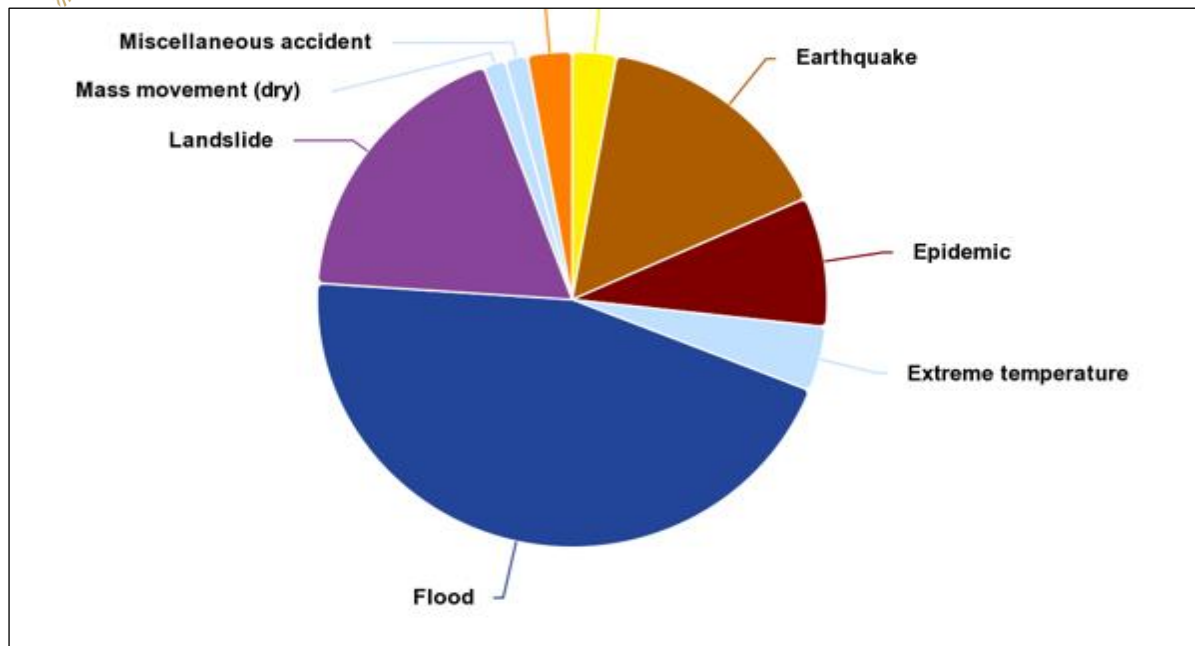
Source: World Bank (2021). Assessment of Contributing Factors of the May 2021 Disasters in Tajikistan: A Forensic Study. World Bank, Washington DC

Figure 14. Average annual natural hazard occurrence in Tajikistan for 1980-2020

¹² World Bank (2021). Tajikistan Preparedness and Resilience to Disasters Project (P177779). World Bank, Washington DC

¹³ World Bank (2021). Assessment of Contributing Factors of the May 2021 Disasters in Tajikistan: A Forensic Study. World Bank, Washington DC

¹⁴ DRM KC (2022). INFORM Risk Index 2022. Disaster Risk Management Knowledge Centre, European Commission, Ispra



Source: World Bank (2021). Assessment of Contributing Factors of the May 2021 Disasters in Tajikistan: A Forensic Study. World Bank, Washington DC

The natural hazard environment of the corridor is driven by the interaction of four primary factors: steep and geomorphologically active valley topography; complex, frequently fractured and weathered geology; a seasonal precipitation regime concentrated in spring and associated with snowmelt; and active tectonic conditions. These factors combine to produce a corridor in which multiple hazard types are simultaneously active across much of the alignment and in which hazard events frequently cascade — rainfall or seismic events triggering slope failures, which may subsequently block drainage structures or the river channel, generating secondary flooding or debris flow hazards.

Systematic hazard survey

A systematic field survey of climate-related hazards along the full corridor was conducted in 2023 as part of a Climate Risk Assessment (CRA)¹⁵ for the Project, using geolocated field data collection at approximately 100 locations. Each location was classified by hazard type and magnitude (low, moderate, high) using the Open Data Kit (ODK) mobile data collection platform. The survey confirmed that climate-related hazard exposure is pervasive and spatially distributed throughout the corridor rather than confined to discrete locations. The most prevalent hazard type identified was flooding, followed by landslides and rockfall.

In parallel, a geotechnical survey conducted by international specialists in June 2023 identified 95 specific hazard locations across 14 sectors of the alignment, covering seven distinct hazard categories (DITI, 2023). Rock mass failure and rockfall were identified as the most frequent hazard type, present throughout the full length of both sections. Landslides, including already-mobilised failures, were concentrated particularly in Sectors 7 and 2 (km 25–32 and km 3–8). Active debris flows and mudflows were documented at multiple tributary crossings, including a live mudflow event observed during the site visit. These two independent surveys — one based on remote sensing and field reconnaissance, the other on direct engineering inspection — are broadly consistent in their identification of hazard distribution and confirm the high spatial density of hazard exposure along the corridor.

Flooding and fluvial erosion

Flooding represents the most widespread and hydraulically consequential hazard along the alignment. Extended sections of the corridor run adjacent to or within the active floodplain of the Shurobdaryo,

¹⁵ Pérez Chaves (2023). Climate Risk and Adaptation Assessment (CRA) — Baljuvon–Sari Khosor Road.

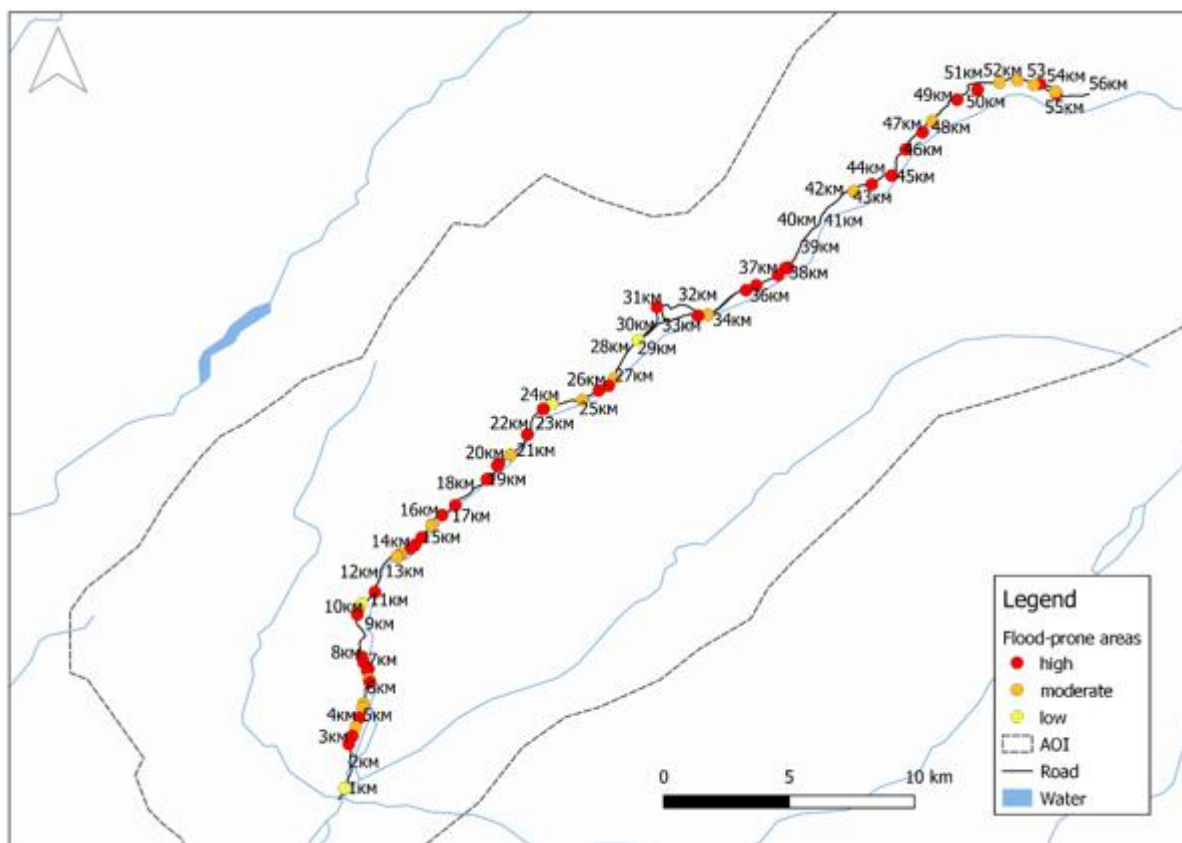
which drains a large mountainous catchment fed by snowmelt and rainfall. The river system exhibits strong hydrological variability, with tributary channels that may be dry for much of the year but convey significant volumes of water and sediment during storm events. The narrow, confined valley morphology intensifies hydraulic forces during flood conditions, and lateral channel migration and bank erosion are active processes that have historically damaged embankment protection works along the corridor (CRA, 2023).

Probabilistic flood depth modelling at the 100-year return period, using the flood hazard framework presented in the CRA, confirms the following flood exposure by corridor section:

- km 0–5: maximum flood depth 150 cm
- km 5–10: maximum flood depth 176 cm
- km 10–16: maximum flood depth 263 cm
- km 43–46: maximum flood depth 107 cm

Peak discharge in the corridor under extreme conditions has been estimated at approximately 653 m³/s in the Project hydrological assessment, with localised flow velocities potentially exceeding 7 m/s in constricted valley sections. These values are consistent with the observed destruction of existing concrete slab bank protection structures at multiple locations along the alignment under past flood conditions.¹⁶

Figure 15. Flood-prone areas throughout the project area



Source: CRA, 2023

¹⁶ Kocks Consult / DITI (2023). Engineering-Geological and Geotechnical Survey Report — Baljuvon–Sari Khosor Road. PIURR, Ministry of Transport, Republic of Tajikistan.

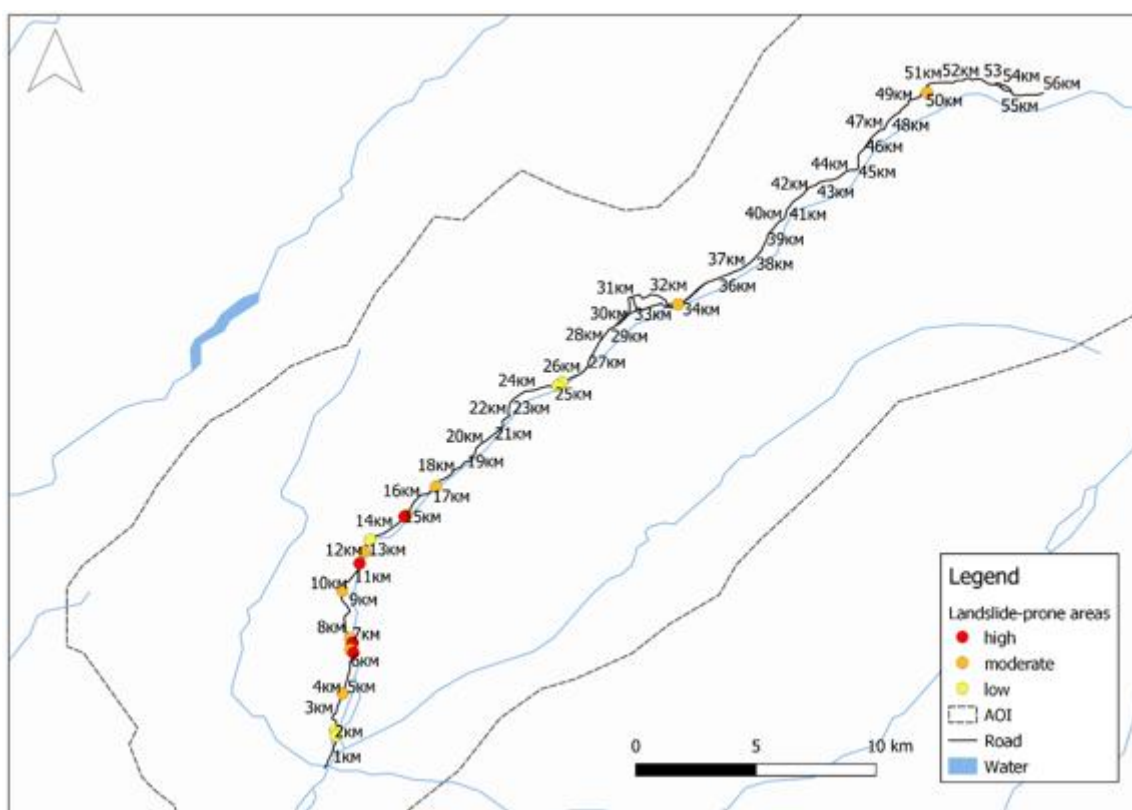
Rainfall analysis at the Khovaling station based on data from 1979 to 2011 records a 24-hour rainfall total of 84.4 mm at the 10-year return period and 132.3 mm at the 100-year return period (UNDP, 2018). The CRA baseline modelling confirms current average daily maximum rainfall (RX1DAY) of 99.6 mm in the northern corridor sections and 88.2 mm in the southern sections, rising to 177 mm and 145 mm respectively at the 100-year return period (CRA, 2023). The relationship between these values and the design rainfall assumptions applied in the Project hydrological assessment is discussed further in Section 6.1.8.

Tributary valleys and alluvial fans introduce additional flood and debris flow risk at crossing points along the alignment. Rapid runoff concentration in steep tributary catchments can generate flash flooding and high sediment loads with limited warning. Active debris flow events were observed at multiple tributary crossings during a June 2023 geotechnical site visit.¹⁷

Landslides and slope instability

Slope instability in multiple forms — shallow translational failures, deep-seated landslides, mudflows, and soil creep — is widespread throughout the corridor.

Figure 16. Landslide-prone areas throughout the project area



Source: CRA, 2023

The principal drivers are steep valley sides and cut slopes; shallow and weakly consolidated colluvial and deluvial soils derived from weathered bedrock; active groundwater seepage associated with snowmelt infiltration and rainfall; and freeze-thaw cycling that progressively weakens slope materials at mid- to upper-corridor elevations. Landslide-prone areas were identified by the CRA field survey throughout the alignment, with the highest concentrations in sections where the road traverses steep

¹⁷ Kocks Consult / DITI (2023). Engineering-Geological and Geotechnical Survey Report — Baljuvon-Sari Khosor Road. PIURR, Ministry of Transport, Republic of Tajikistan.



valley sides. The geotechnical survey identified landslide concentrations in Sector 7 (km 25–32) and Sector 2 (km 3–8), including already-mobilised failures that remain active.¹⁸

Fine-grained silty soils present at multiple locations are prone to rapid loss of strength when saturated. Annual rainfall across the project road of 600–1,000 mm, concentrated in spring (CRA, 2023), represents an effective trigger for shallow slope failures. Slope failures are most frequent during and immediately following the spring wet season and following seismic events.

Debris flows and mudflows

Debris flows and mudflows represent a distinct and particularly damaging hazard category along the corridor. The corridor crosses multiple tributary valleys whose catchments — characterised by steep headwaters, sparse vegetation, and erodible soils — are capable of generating high-magnitude debris flows during intense or prolonged rainfall. A live mudflow event was observed in one such tributary during a June 2023 geotechnical site visit,¹⁹ confirming that these processes are active under current baseline conditions. Debris flows represent a specific design challenge for drainage structures because their high sediment concentrations and boulder content can block or overtop culverts and bridges that would be adequate for clear-water flood flows.

Rockfall and rock mass failure

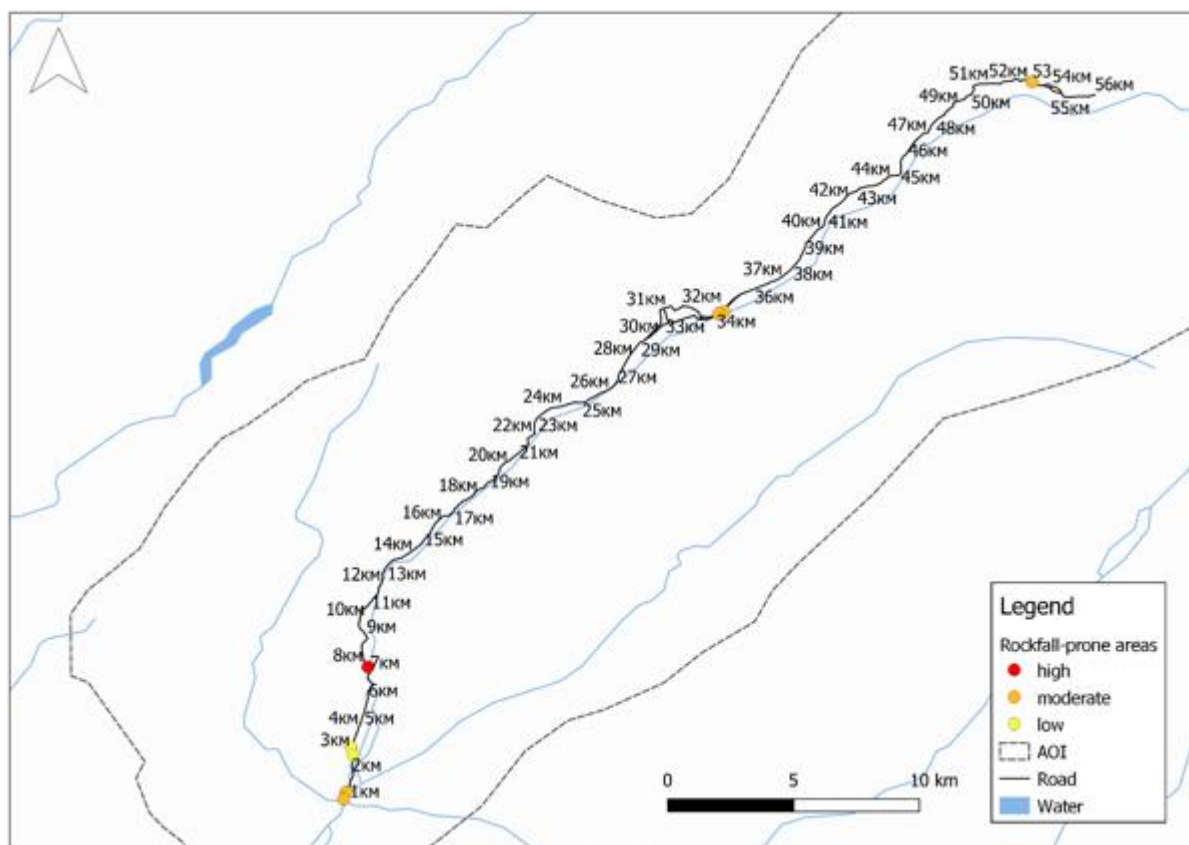
Rock mass failure and rockfall were identified as the most frequent single hazard category across the corridor in the geotechnical survey, present throughout both sections.²⁰ Outcrops of fractured and weathered bedrock — including sandstones and siltstones with clay cement — on the steep slopes above the alignment generate persistent rockfall risk. Freeze-thaw cycling at mid- and upper-corridor elevations progressively widens fractures and releases individual blocks and wedges. Rockfall risk is highest during the spring thaw period and following seismic events. The CRA field survey documented rockfall-prone areas from near km 0.5 throughout the full corridor, with specific high-risk locations recorded near km 7 (CRA, 2023).

¹⁸ Kocks Consult / DITI (2023). Engineering-Geological and Geotechnical Survey Report — Baljuvon–Sari Khosor Road. PIURR, Ministry of Transport, Republic of Tajikistan.

¹⁹ Kocks Consult / DITI (2023). Engineering-Geological and Geotechnical Survey Report — Baljuvon–Sari Khosor Road. PIURR, Ministry of Transport, Republic of Tajikistan.

²⁰ Kocks Consult / DITI (2023). Engineering-Geological and Geotechnical Survey Report — Baljuvon–Sari Khosor Road. PIURR, Ministry of Transport, Republic of Tajikistan.

Figure 17. Rockfall-prone areas throughout the project area



Source: CRA, 2023

Seismicity

The entire project corridor lies within an 8-point seismic zone according to the national seismic zoning map of Tajikistan (MKS 22.07.-2015), with soil category II at construction sites. This is a high seismic hazard classification consistent with Tajikistan's position at the convergence of the Indian and Eurasian plates within the Pamir–Tien Shan tectonic system. Seismic events can directly trigger slope failures, rockfall, and liquefaction, and can damage drainage structures, embankments, and bridges. The 8-point seismic zone classification informed the selection of monolithic in-situ bridge construction over precast alternatives, as discussed in Section 4.

Snow-related hazards

At mid- to upper-corridor elevations, seasonal snow accumulation, prolonged snow cover, and localised avalanche risk represent hazards to road access and safety. Average maximum snow depths recorded at the Hovaling meteorological station (1,463 m asl) reach 32 cm, with recorded maxima of 60 cm.²¹ Snow cover persists through winter and into spring, with spring snowmelt contributing substantially to peak river discharge and slope instability. Seasonal road closures due to snow accumulation have historically caused temporary isolation of upper-corridor communities, and snowmelt-driven flooding and mudflows in April–May are among the most significant annual infrastructure risks along the alignment.

Permafrost

²¹ Kocks Consult / DITI (2023). Engineering-Geological and Geotechnical Survey Report — Baljuvon–Sari Khosor Road. PIURR, Ministry of Transport, Republic of Tajikistan.



Permafrost is not present within the project elevation range. The corridor extends from approximately 926 m to 1,658 m above sea level (CRA, 2023). Regional permafrost modelling indicates that discontinuous and sporadic permafrost in the Khatlon Region occurs only at elevations above approximately 2,000 m. Permafrost is therefore screened out as a relevant hazard for this Project.

Summary of hazard distribution

The approximately 100 hazard locations identified across the 56 km corridor represent an average of approximately 1.8 hazard locations per kilometre of alignment (CRA, 2023), confirming that the corridor operates throughout within a high-hazard environment rather than being exposed to hazards at discrete points. Flooding and fluvial erosion dominate in the lower valley sections closest to the active channel; slope instability and rockfall are prevalent throughout both sections wherever the road traverses steep valley sides; and debris flows are concentrated at tributary crossings along the full length of the alignment.

6.1.6. Topography

The topography of the BSK corridor is a defining feature of the Project. The road traverses a steep, deeply incised mountain valley in which the available terrain directly constrains where the road can go, how much space is available for construction, and which natural hazard processes are most relevant. This section describes the topographic baseline from the regional setting through to corridor-scale characteristics, and identifies the principal implications for road design, construction, and environmental management.

Regional Topographic Setting

The Project area lies within the south-western foothills and valley systems of the Pamir-Alay mountain range, in Baljuvon District of Khatlon Region, at the south-eastern end of the Vakhsh Range. The surrounding landscape is characterised by high ridgelines and deeply incised valleys, formed by rivers cutting downward in response to the ongoing geological uplift of the range. Elevations in the broader region range from around 300–500 m in the western foothills to over 3,000–4,000 m in the mountain interior. The Vakhsh Range immediately surrounding the corridor rises to over 3,000 m (Kocks Consult / DITI, 2025). The road corridor itself spans from approximately 926 m above sea level near Baljuvon to approximately 1,648 m near Sari Khosor Hotel — a net elevation gain of around 720 m over 56 km, with a total cumulative elevation change of approximately 1,445 m when the full rise and fall of the valley profile is accounted for (CRA, 2023). The average longitudinal gradient along the corridor is approximately 3%.

The corridor is located within an actively evolving landscape. Ongoing tectonic uplift drives continued river incision, while erosion and mass movement processes continuously rework valley slopes and floors. Infrastructure in this setting must be designed to accommodate a terrain that is changing rather than static.

Corridor Elevation and Longitudinal Profile

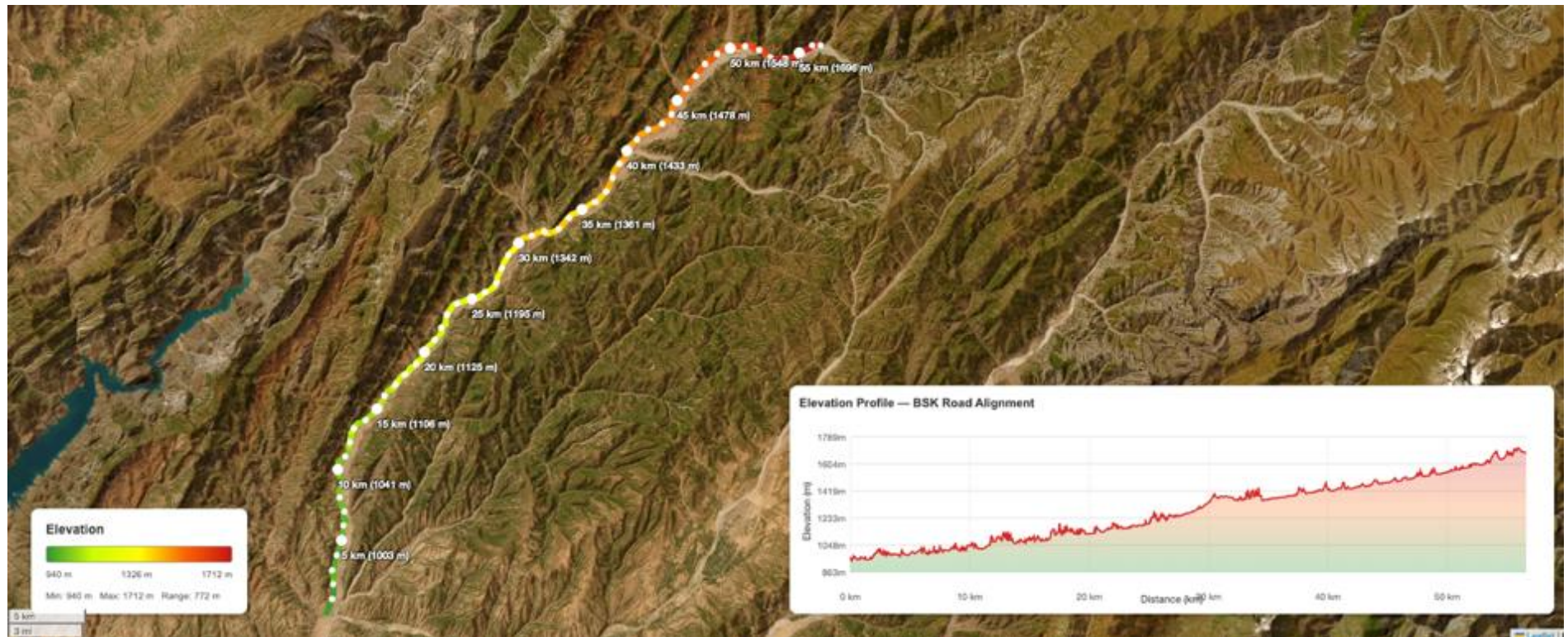
The corridor follows the Shurobdaryo valley from near Baljuvon (km 0, elevation approximately 926 m) to the end of the alignment (km 56, elevation approximately 1,637–1,648 m), with an average elevation of approximately 1,263 m (CRA, 2023). Elevation increases progressively but not uniformly along the route, with steeper and more gradual sections reflecting local geological controls on valley floor morphology.

The two corridor sections have distinct characters. Section 1 (km 0–20.1) follows the lower valley at elevations of approximately 926–1,100 m, climbing gradually and relatively consistently. Section 2 (km 20.1–56.3) ascends more steeply and unevenly through the mid and upper valley, reaching approximately 1,350–1,400 m in the Shahidon area around km 30 before rising further — with considerable undulation — to the road terminus near Sari Khosor hotel.



Maximum longitudinal slopes on the existing alignment reach 13–15% in the most constrained sections, with an average of approximately 3% across the full corridor (CRA, 2023). Side gullies and ravines intersect the alignment at frequent intervals throughout both sections, requiring drainage structures to manage runoff from the surrounding slopes.

Figure 18: Elevation range for the road project (from 926 to 1658 meters above sea level)



Source: Google Earth / Vista Environment AB



The change in elevation along the corridor has direct implications for hazard exposure, climate conditions, and construction complexity:

- a) In the lower sections (approximately km 0–15, elevation 926–1,100 m), gradients are more moderate and the valley floor is relatively wider, but these sections are most exposed to river flooding and bank erosion from the main Shurobdaryo channel.
- b) In the mid-corridor sections (approximately km 15–35, elevation 1,100–1,400 m), the valley narrows and valley sides steepen, with increasing influence from slope instability and debris processes in tributary catchments.
- c) In the upper sections (approximately km 35–56, elevation 1,400–1,648 m), terrain conditions are at their most demanding — very steep valley sides, gorge-like valley profiles in places, and the greatest exposure to slope failure, rockfall, and snow-related hazards.

Valley Cross-Section and Working Envelope

The width of the Shurobdaryo valley floor is a critical constraint on the road corridor. For much of its length, the valley floor is narrow — in places just a few tens of metres between the river channel and the base of the valley sides — with the active river channel and the road occupying the same confined space. This proximity between road and river is one of the most significant characteristics of the corridor.

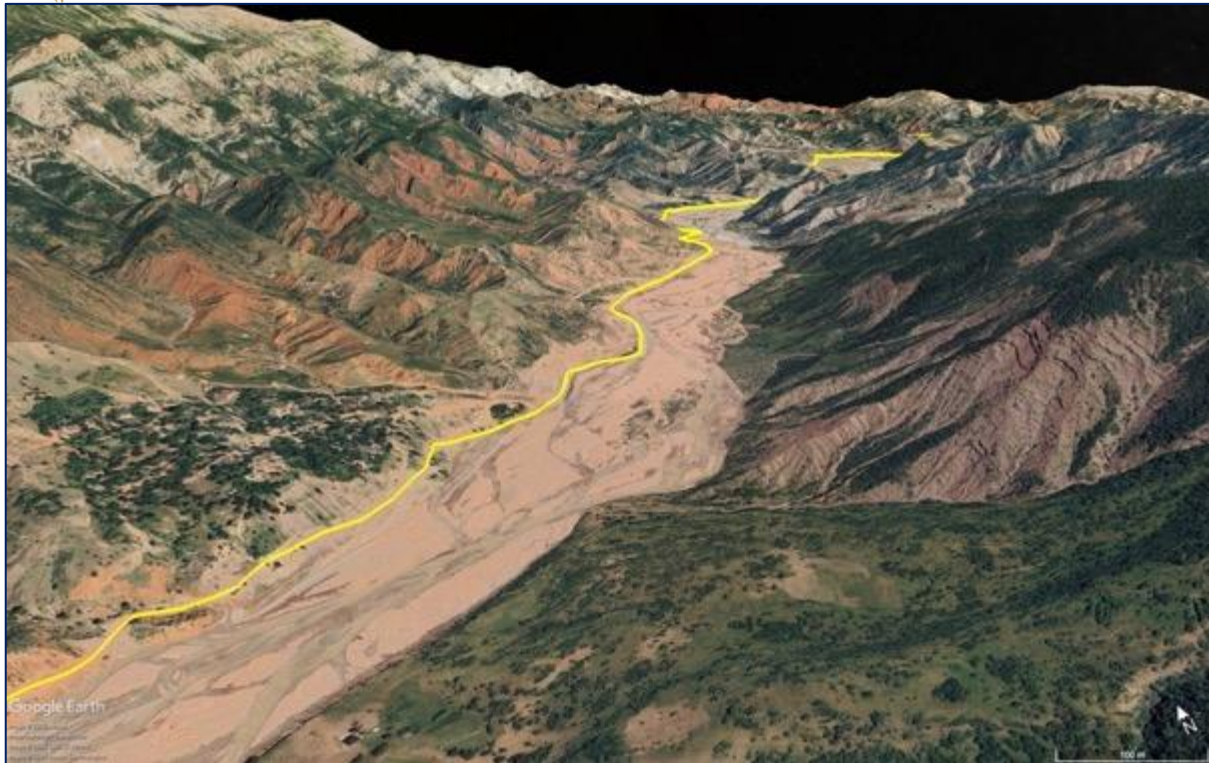
In the lower sections, the valley periodically widens to create small floodplain areas and river terraces, where some agricultural land and settlement infrastructure is located. Further up the corridor, these openings become less frequent. In the mid- and upper-valley sections, there are extended reaches — described in design documentation as gorge or near-gorge sections — where the river runs directly against steep valley walls with effectively no flat ground between them. In these locations, a road can only be accommodated if it is built immediately alongside the river or constructed on engineered embankments and retaining structures cut into the valley side. Between km 36 and km 56, the existing track has largely disappeared and vehicles currently travel along the riverbed,²² which illustrates the severity of the spatial constraint in the upper corridor.

The space available for road construction therefore varies considerably along the alignment. Where the valley is wider, there is modest flexibility for alignment adjustment and drainage design. In the gorge sections, widening to the full Category V standard will require retaining walls or other structural solutions to create adequate formation width without further encroaching on the river channel.

Valley side slopes are steep throughout most of the corridor, commonly exceeding 30–45 degrees in the mid- and upper-corridor zones, with locally near-vertical faces in gorge sections and at bedrock outcrops. Slopes of this gradient are inherently prone to instability when disturbed, which is a primary driver of the geotechnical risks described in Section 6.5.

Figure 19: Valley Cross Section (road alignment in yellow)

²² Kocks Consult / DITI (2023). Engineering-Geological and Geotechnical Survey Report — Baljuvon–Sari Khosor Road. PIURR, Ministry of Transport, Republic of Tajikistan.



Source: Google Earth, 2026

Tributary Valleys and Geomorphic Features

The Shurobdaryo valley is intersected by numerous tributary valleys and drainage channels bringing runoff and sediment down from the surrounding hillsides. These tributaries are a characteristic feature of the corridor, with direct implications for road design and safety.

Where tributaries meet the main valley, alluvial fans and debris flow have accumulated — deposits built up over many years of repeated sediment delivery during high-intensity events. These fans are active: they continue to receive new material during storm events, and their structure can change rapidly during significant debris flow episodes. Where the road crosses a fan surface or passes immediately below one, this represents an ongoing and recurrent hazard.

Tributary junctions are among the most topographically constrained points on the corridor. In these locations, the combination of the fan deposit, the side channel, and the main river can together occupy the full available valley floor width, leaving little room for road infrastructure and drainage structures. Fifteen discrete mudflow channel (sai) crossings requiring outlet structures and retention dams have been identified along the alignment.²³

Larger tributary catchments can generate substantial debris and water volumes during extreme events. The steep gradient of these tributaries — descending rapidly from high ground before depositing on fans in the main valley — means that flows can be fast-moving and carry material a considerable distance across the road alignment.

Road–River Interaction and Floodplain Geometry

The relationship between the road alignment and the active channel and floodplain of the Shurobdaryo is one of the most important topographic characteristics of the corridor. Over extended

²³ Kocks Consult / DITI (2023). Engineering-Geological and Geotechnical Survey Report — Baljuvon–Sari Khosor Road. PIURR, Ministry of Transport, Republic of Tajikistan.



sections, the road runs directly adjacent to or within the floodplain, with no meaningful separation from the active channel during flood events.

Flood depths along sections of the lower corridor (approximately km 0–5) can reach approximately 1.5 m during 100-year return period events, rising to approximately 2.6 m between km 10 and km 16. Peak discharges during extreme events have been estimated at approximately 653 m³/s, with flow velocities potentially exceeding 7 m/s in constricted valley sections (CRA, 2023). These are conditions capable of undermining road embankments, as past flood events along the corridor have demonstrated.

The river also migrates laterally over time, shifting its channel position across the valley floor as flow conditions and sediment loads change. Outer bends are particularly exposed, as this is where the current acts with greatest force against the bank. In a valley as narrow as the Shurobdaryo for most of its length, the river has limited space to migrate without directly affecting the road, making bank protection works necessary along many sections of the corridor.

Existing Road Formation and Human Modification of Topography

The existing road represents a significant change of the natural valley topography, created through a combination of cutting into valley sides and filling to build up the road surface. These original works altered drainage patterns, slope geometries, and surface materials along the alignment. The condition of the existing cut slopes and embankments is poor across much of the route. Cut faces have eroded and in places collapsed, depositing material on the road. Embankments beside the river have been undercut and eroded by flood events. At several locations, sections of the embankment have been partially or completely destroyed. In the upper section between km 36 and km 56, the road no longer functions as a formed structure and vehicles must use the riverbed.

Topographic Constraints on Settlements and Land Use

The narrow topography of the corridor directly shapes where people live and farm. Settlements and agricultural land are concentrated on the limited flat ground available within the valley — river terraces and the margins of the valley floor — and in many cases this flat ground coincides with the road corridor itself.

Around 19 settlements lie along or adjacent to the route, with a combined population of more than 6,000 residents across two jamoats. The two largest concentrations are near Shahidon (approximately km 30) and Mullokoni (approximately km 54), both in sections where the valley floor is relatively constrained and the road passes close to or through settlement areas.

Agricultural plots along the corridor are typically small, reflecting the scarcity of suitable land in a steeply incised mountain valley. Many are irrigated from small channels fed by tributary streams.

Topographic Zone Summary

The BSK corridor is characterised across three topographic zones for the purposes of this ESIA. The key characteristics of each zone are summarised in Table 24 below.

Table 24: Summary of Topographic Characteristics by Corridor Zone

Zone	Approx. Chainage	Elevation Range	Valley Floor Width	Valley Side Gradient	Key Topographic Features	Principal Design Constraint
Lower valley	~km 0–15	~926–1,100 m asl	Wider relative to mid/upper sections; floodplain	Gentle to moderate	Floodplain and active channel adjacency; embankment exposure to river	River flooding; embankment scour and lateral erosion

Zone	Approx. Chainage	Elevation Range	Valley Floor Width	Valley Side Gradient	Key Topographic Features	Principal Design Constraint
			present in places		migration; agricultural terraces on valley margins	
Transitional mid-valley	~km 15–35	~1,100–1,400 m asl	Narrow; confined gorge sections alternate with minor widening at tributary junctions	Moderate to steep	Steep valley sides; alluvial fans at tributary junctions; Shahidon settlement area (~km 30) on narrow valley floor	Slope instability; debris fan encroachment; constrained widening opportunities
Upper mountain	~km 35–56	~1,400–1,648 m asl	Very narrow; gorge character in many sections; no formed road in places	Steep to very steep	Near-vertical valley sides in places; deep tributary incision; Mullokoni area (~km 54) in confined section; road absent km 36–56	Rockfall; slope failure; snow accumulation; very limited construction working space; full road reconstruction required

Source: Based on desktop review of available topographic data, the Project feasibility study and preliminary design documentation (Kocks Consult / DITI, 2025), Climate and Hazard Assessment (CRA, 2023), and ESIA team site observations (2025).

6.1.7. Soils and Geology

This section describes the underlying geological setting, the soil conditions along the route, the active landscape processes currently at work, and what all of this means for construction and long-term road performance.

Geological Setting

The corridor sits within the south-western edge of the Pamir-Alay mountain system, one of the most geologically complex and seismically active parts of Central Asia. The mountains are the product of the ongoing collision between the Indian and Eurasian tectonic plates — a process that has been folding, faulting, and uplifting the crust of this region for tens of millions of years and continues to do so today. The geological history is visible throughout the corridor: fractured and disturbed rock, complex and variable subsurface conditions, and a landscape that remains geologically active. The rock formations underlying the corridor reflect this tectonic complexity. They have been compressed, stacked, and deformed into a series of thrust sheets and folded structures, which means that rock types and their orientations can change significantly over relatively short distances along the alignment. The principal rock types present are:

- **Sedimentary rocks** — sandstones, siltstones, mudstones, and shales, mostly of Mesozoic and Cenozoic age. These are the most common materials along the corridor. Their engineering quality varies considerably depending on how well cemented they are, how much clay they contain, and how extensively they have been fractured by tectonic activity. Shales and mudstones are the weakest of these, tending to break down and lose strength when exposed to water or weathering.

- **Metamorphic rocks** — found locally where sedimentary rocks have been altered by the heat and pressure of tectonic deformation. These include phyllites, schists, and quartzites. As a group they tend to be stronger than the sedimentary rocks, but they often contain pronounced internal layering planes (foliation or schistosity) that can act as preferential failure surfaces in cut slopes.
- **Intrusive igneous rocks** — present in minor occurrences in parts of the broader region, associated with ancient magmatic activity. These are not a dominant material along the corridor.

A feature common to all rock types along the corridor is fracturing and surface weathering. River incision has exposed the valley walls over long timescales, and the combination of physical and chemical weathering has degraded rock quality near the surface. The depth at which weathered rock gives way to fresher, stronger material varies considerably from place to place along the alignment. This variability is relevant to the design of cut slopes, foundations for structures such as bridges and culverts, and any retaining wall elements required during construction.

Active faulting is a recognised feature of the region. Both major fault lines and smaller secondary structures are mapped in the geological record for the area. Where faults pass through or near the corridor, they are associated with zones of more intensely fractured and weaker rock. The presence of active or recently active faults is also a key input to the seismic hazard assessment discussed in Section 6.3.8.

Soil Conditions

Soils along the BSK corridor are predominantly thin to moderately deep surface deposits overlying bedrock, reflecting a landscape that is geologically young and actively eroded. Well-developed soils — with deep profiles, significant organic matter, and distinct soil horizons — are largely absent on the steeper sections of the alignment and in areas regularly disturbed by slope movement or flooding. Better-developed soils are found mainly on valley floors and lower terraces, where alluvial deposition has built up more substantial material over time, and where some of these areas are used for agriculture. Five principal soil types are relevant to the corridor, summarised in Table 25.

Table 25: Principal Soil Units along the BSK Corridor

Soil Unit	Occurrence along Corridor	Physical Characteristics	Engineering Sensitivity	Disturbance Sensitivity
Colluvial and deluvial slope soils	Slopes, valley sides, and hillsides throughout the corridor	Shallow to moderately deep (typically 0.3–2 m); variable texture; mixtures of silts, sands, gravels, and rock fragments	Prone to surface erosion and shallow mass movement when disturbed or de-vegetated; drainage conditions typically poor to moderate	MODERATE–HIGH
Aleuritic (silty) soils	Localised occurrences in valley sections and on lower slopes; identified in several sections of the corridor	Fine-grained, silty; may form layers within colluvial profiles	High sensitivity to moisture change; significant loss of shear strength when saturated; susceptible to shallow flow-type failure and surface erosion	HIGH

Soil Unit	Occurrence along Corridor	Physical Characteristics	Engineering Sensitivity	Disturbance Sensitivity
Alluvial valley-floor soils	Valley bottom, river terraces, and floodplain areas along the Shurobdaryo and principal tributaries	Variable depth (0.5–3 m+); sandy to gravelly; locally silty layers; immature development	Susceptible to erosion and scour during high-flow events; locally susceptible to liquefaction during seismic shaking	MODERATE–HIGH
Residual and weathered bedrock soils	Thin occurrences on steeper slopes where erosion limits soil development; beneath colluvial cover on upper slopes	Very shallow (0–0.5 m); highly variable depending on parent rock type	Limited engineering value; high erosion susceptibility when exposed by excavation	MODERATE
Made ground / road fill	Beneath and adjacent to the existing road formation throughout the corridor	Variable composition; typically unengineered fill comprising mixed excavated material	Potentially unstable under additional loading or altered drainage; relevant to pavement foundation design	MODERATE

Source: Based on ESIA desktop review, the Project feasibility study, scoping study geological characterisation, and ESIA team site observations (2025). Final soil unit boundaries to be confirmed against geotechnical investigation outputs.

The aleuritic (silty) soils deserve particular attention. These fine-grained soils can appear reasonably stable when dry or only moist, but when they become saturated they can lose strength rapidly and transition to a flow-like failure with little warning. This behaviour makes them one of the more hazardous soil types from a road stability perspective, and sections of the corridor where these soils are present at or near the surface are zones of elevated geotechnical risk — particularly during the spring wet season and immediately following construction disturbance.

Colluvial and deluvial slope soils cover most of the hillside sections of the corridor. They are variable in composition, reflecting a mixed history of bedrock weathering, slope wash, and periodic mass movement, which means their engineering properties can change significantly over short distances.

Alluvial soils on the valley floor and river terraces are important both as foundation materials for structures — embankments, culvert headwalls, and bridge abutments — and as an indicator of flood and erosion exposure. Their susceptibility to scour during high-flow events means that any foundations placed in these materials need adequate protection against undermining. Where these soils are saturated, they may also be susceptible to liquefaction under seismic loading, as discussed in Section 6.3.8.

Active Geomorphological Processes

The landscape of the BSK corridor is not stable — it is actively changing under the influence of several interacting processes driven by steep terrain, weak and fractured geological materials, active river systems, and a seasonal climate characterised by intense rainfall and snowmelt. Evidence of ongoing geomorphological activity is visible throughout the corridor. The principal processes at work are:

- Surface erosion and slope wash — the progressive removal of material from hillslopes by rainfall, rilling, and sheet flow. This is most active on bare or sparsely vegetated slopes and intensifies during the spring season. The existing road has contributed to this process by creating areas of exposed, unprotected material through previous cutting and filling operations.



- Mass movements — including shallow landslides, rotational and planar slope failures, and flow-type failures in silty materials. Evidence of past and recent slope failures can be found along the alignment.
- Debris flows and mudflows — fast-moving mixtures of water, sediment, and rock material that are active in multiple tributary catchments intersecting the corridor.
- River bank erosion and channel migration — the Shurobdaryo actively erodes its outer banks, deposits material on inner banks, and periodically spreads across the full floodplain width during flood events. Undercut banks, collapsed embankment sections, and exposed tree roots are visible at numerous points along the road, reflecting the scale and frequency of this process.
- Alluvial fan growth — tributary fans at the foot of side valleys continue to grow outward as debris flows and high-energy runoff events deliver new material.
- Rockfall and talus accumulation — material continues to fall from steep rock faces and accumulate as talus at the base of slopes, driven by freeze-thaw cycling and occasional seismic activity. The presence of active talus slopes indicates ongoing material supply from above.

The distribution of these processes varies along the corridor. Geomorphological activity generally intensifies from lower to upper sections, in line with the increase in slope gradient and terrain complexity. River-related processes — flooding and bank erosion — are most significant in the lower and mid-corridor sections where the road is closest to the main channel.

The key implication for the Project is that construction activities will not take place in a passive environment. Cutting slopes, filling ground, removing vegetation, and altering drainage patterns will interact directly with processes that are already active, with the potential to accelerate erosion and destabilise slopes that are currently in a precarious equilibrium. These interactions are assessed in the construction-phase impact assessment in Chapter 7.

6.1.8. Water Resources and Hydrology

This section describes the surface water baseline, the seasonal and flood hydrology of the corridor, and the implications for the Project.

The Shurobdaryo System

The primary watercourse along the corridor is the Shurobdaryo, which forms the source reach of the Kyzylsu-Southern River system. The Shurobdaryo drains a large mountain catchment whose average elevation exceeds 2,000 m above sea level — a characteristic that has direct consequences for how the river behaves.²⁴ At this altitude, winter precipitation falls predominantly as snow, and the river receives mixed snow and rain feeding. This means that river levels are tied closely to two seasonal drivers: the timing and intensity of the spring snowmelt, and the occurrence of intense rainfall events, particularly in spring.

The Shurobdaryo is not a stable, well-defined channel for most of its length. In the mid and upper sections of the corridor, the river has an active, wandering planform — it does not follow a single fixed course but shifts laterally across the valley floor, particularly during high flows. This lateral mobility is a persistent threat to road embankments built in close proximity to the channel. Where the river bends, the outer bank is subject to direct erosion; where it floods, it can spread across the full available valley floor width. These are not occasional or unusual events — they are a normal part of how this river functions.

²⁴ Kocks Consult / DITI (2023). Engineering-Geological and Geotechnical Survey Report — Baljuvon–Sari Khosor Road. PIURR, Ministry of Transport, Republic of Tajikistan.



Seasonal Flow Regime

The flow regime of the Shurobdaryo and its tributaries is strongly seasonal and dominated by two main periods of high water. Flooding typically begins in February as temperatures start to rise and the snowpack begins to melt. Peak annual discharges occur in April and May, when snowmelt and seasonal rainfall coincide, producing the highest and most sustained flows of the year. After the peak, flows decline through June and reach their lowest point between June and August, before recovering slightly with autumn rains.

The tributary streams crossing the corridor follow a similar but more extreme pattern. Most are ephemeral or intermittent — dry or carrying minimal flow for much of the year — but during the spring season and following intense rainfall events they can carry very large volumes of water and sediment very quickly. Because tributary catchments are steep and relatively small, their response to rainfall is rapid: water levels can rise suddenly, delivering flows that carry a high sediment and debris load.

A particularly significant characteristic of these watercourses is their tendency to produce debris flows rather than clean water floods. Because the underlying rocks along the corridor are easily eroded, intense rainfall mobilises not just water but also sediment, rock fragments, and organic material, producing fast-moving flows of mixed debris that can damage or block drainage structures and overwhelm culverts sized only for liquid discharge.²⁵ The highest annual water discharges occur in April–May and are predominantly of rainfall origin, with rainfall-driven runoff maxima significantly exceeding snowmelt peaks; when intense rain falls on already-saturated catchments, the resulting flows readily acquire debris flow character.

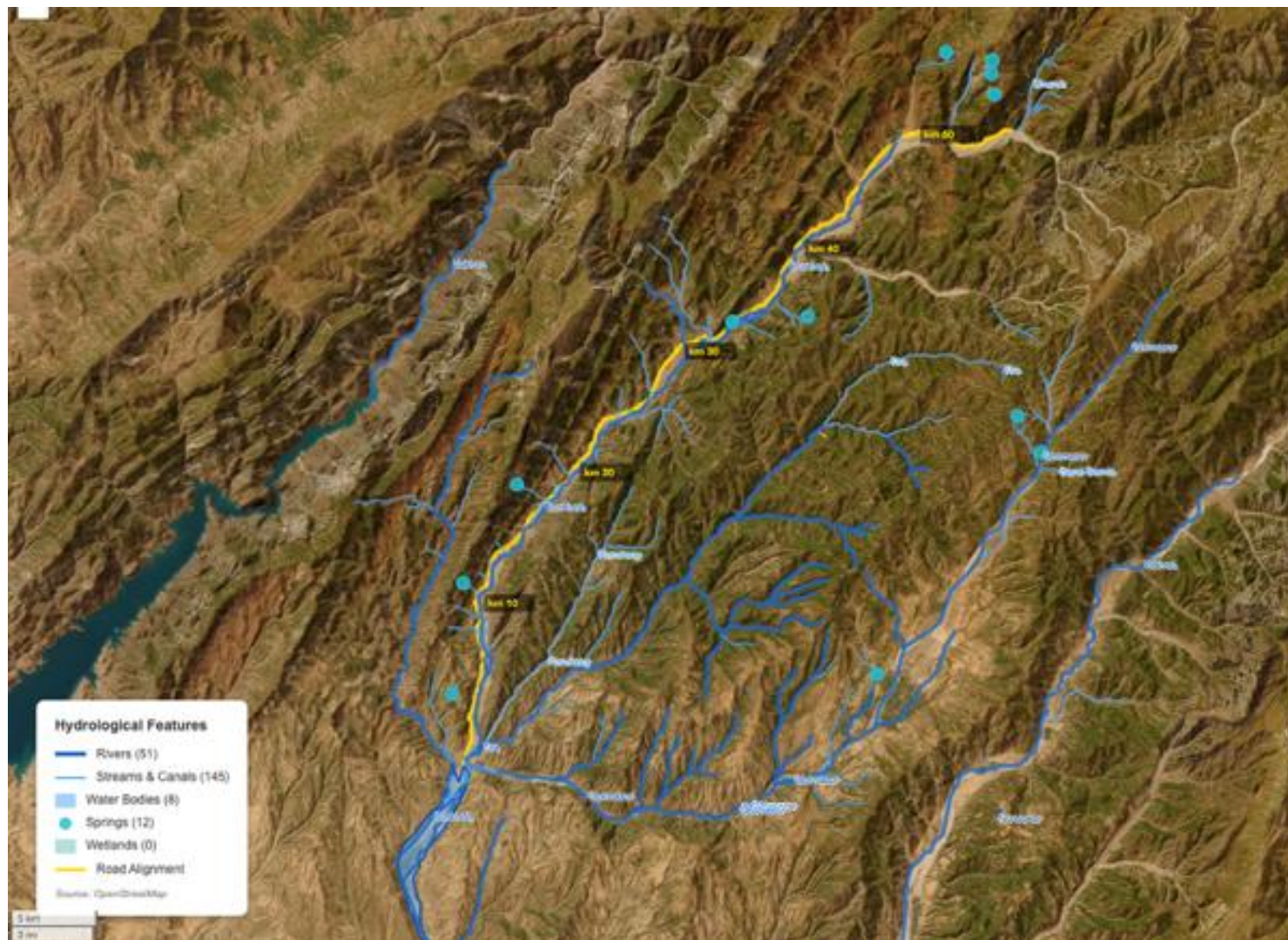
Tributary Catchments and Crossing Points

The corridor is intersected by approximately 48 hydraulically significant low points where tributary drainage crosses the road alignment.²⁶ The majority of these are small catchments active only during snowmelt and rainfall events, but twelve have catchment areas exceeding 2 km² and generate flows large enough to require engineering design attention. Seven of the most hydraulically demanding crossings are planned for bridge structures rather than culverts, reflecting the scale and debris-laden character of flows at these locations.

²⁵ Kocks Consult / DITI (2023). Engineering-Geological and Geotechnical Survey Report — Baljuvon–Sari Khosor Road. PIURR, Ministry of Transport, Republic of Tajikistan.

²⁶ Kocks Consult / DITI (2023). Engineering-Geological and Geotechnical Survey Report — Baljuvon–Sari Khosor Road. PIURR, Ministry of Transport, Republic of Tajikistan.

Figure 20: Key Hydrological Features in the Region



Source: Vista Environment AB

The named tributaries and their principal characteristics are summarised in Table 26 below. All catchments in the study area have average elevations exceeding 2,000 m, which means they are snowed in winter and receive mixed snow and rain inputs in spring — conditions that produce rapid, high-volume flows when temperatures rise

Table 26: Principal Tributary Catchments Crossing the BSK Corridor

Location Tributary /	Chainage	Catchment Area (km ²)	Channel Slope (‰)	Avg. Catchment Elevation (km)	Design Debris Flow (2% ER, m ³ /s)	Design Debris Flow (3% ER, m ³ /s)
Doshmandi (1)	KM 18.8	2.19	342	1.65	35.8	29.8
Doshmandi (2)	KM 19.8	4.52	266	1.65	58.6	49.2
—	KM 20.9	3.85	291	1.81	45.8	38.4
Chiltori	KM 21.8	1.73	323	1.62	32.7	26.7
Surbion	KM 22.7	3.68	325	1.89	45.3	38.0
Pasivaram	KM 23.8	6.85	434	1.98	127	106
Dashtikilko	PKM 25.3	6.50	329	2.10	55.2	48.2
—	PKM 25.9	2.48	223	1.54	23.1	20.2
Sangsel (r. Shurob)	KM 26.8	14.7	156	1.90	80.6	67.5
Daraioyobak	KM 28.3	14.7	197	1.91	108	89.8
Bulgori	KM 32.0	18.5	159	2.16	81.5	69.4
Obisafed	KM 33.7	18.3	138	2.06	72.6	62.2

Source: Kocks Consult / DITI (2023), Engineering-Hydrological Surveys, Draft Final Report. Design flows calculated using debris flow methods for a Category IV road; 2% ER = 1-in-50-year exceedance probability (bridges), 3% ER = 1-in-33-year (pipes/culverts). Maximum daily precipitation of 83 mm (1% exceedance probability) based on Khovaling and Kangurt meteorological stations.

Several points stand out from the tributary data. The side valleys are uniformly steep, which means that when flows do occur they build up speed quickly and arrive at the road crossing with considerable force. In catchments where the underlying rock is soft and easily eroded — which is the case for much of the corridor — the resulting flows carry not just water but a mixture of sediment, rock fragments, and debris. This debris-laden character is what makes these crossings more demanding than a simple water discharge calculation would suggest.

The most hydraulically significant crossing in the data set is the Pasivaram tributary at around km 23.8, where the estimated design flow reaches approximately 127 m³/s — roughly double the value at most other crossings. This reflects a combination of a larger catchment, a very steep channel, and highly erodible materials. The three largest tributaries by catchment area — Sangsel, Daraioyobak, and Bulgori — each drain catchments of approximately 15–18 km² and generate estimated design flows in the range of 70–108 m³/s. These are the locations where the hydraulic demands are greatest.

The 2023 hydrological survey covered the upper section of the corridor from Hormo to Sari Khosor — approximately the upper 24 km of the route. Hydrological data for the lower section were established in earlier studies from 1995 and 2013. Across the full 56 km corridor, approximately 48 drainage crossing points have been identified, of which the twelve covered by the 2023 survey represent the most demanding in terms of flow volumes and debris loads.

Design Flood Hydrology — The Main Channel

For the Shurobdaryo itself, design discharges were calculated from observed data at the Bobokhanshaid hydrological station on the Kyzylsu-Southern River, located at the point where the river exits the mountain area. The 2% exceedance probability discharge — the design standard for bridge structures — has been estimated at approximately 480 m³/s. The 5% exceedance probability discharge, used to assess the width of the stable channel in a river without a clearly defined single channel, is estimated at approximately 408 m³/s.²⁷

These figures are consistent with the hydraulic behaviour observed along the corridor: a river capable of spreading across the full available valley floor width during major flood events, with sufficient energy to erode, undercut, and destroy road embankments and bank protection works. Design discharges of this magnitude mean that flood protection structures along river-adjacent sections of the road are not a precautionary addition to the design — they are an essential component of a road that will remain functional over its design life.

Water Quality

Measurement Programme - Baseline water quality in the Shurobdaryo and its principal tributaries was characterised through a field sampling campaign conducted on 22–23 July 2023, as part of the Initial Environmental Examination prepared by the ADB (IEE, March 2025). Eleven water samples were collected at georeferenced locations distributed across the full length of the corridor, from km 1 (Surkhob River, near Baljuvon) to km 56 (Sari Khosor hotel area), providing spatial coverage of the main channel and key tributary inputs. Samples were collected during low-flow dry season conditions, which is an important constraint on the interpretation of results discussed further below.

At each sampling point, ten physico-chemical parameters were measured by laboratory analysis: suspended solids, dry residue, pH, mineralisation, biochemical oxygen demand (BOD₅), chemical oxygen demand (COD), dissolved oxygen (DO), electrical conductivity, petroleum products, and coli-index. Results were assessed against Tajikistan's Maximum Permissible Concentrations (MPC) for surface water bodies, which set separate standards for water bodies of domestic use designation and fishery designation. Sampling locations are summarised in Table 27 below.

Table 27: Baseline Water Quality Sampling Locations (July 2023)

No.	Location	GPS Coordinates	Waterbody
1	km 1+00	38°19'6.33"N, 69°41'11.56"E	Surkhob River
2	km 20+00	38°27'32.22"N, 69°45'8.29"E	Shurobdaryo
3	km 26+00	38°29'37.03"N, 69°47'48.96"E	Bogisogon tributary (south)
4	km 27+00	38°30'3.06"N, 69°48'26.54"E	Bogisogon tributary (north)
5	km 31+00	38°32'2.95"N, 69°49'41.35"E	Shahidon

²⁷ Kocks Consult / DITI (2023). Engineering-Geological and Geotechnical Survey Report — Baljuvon–Sari Khosor Road. PIURR, Ministry of Transport, Republic of Tajikistan.

Source: IEE (2025), Table 29.

Results and Interpretation - With the exception of suspended solids — discussed separately below — measured values for all parameters were within the applicable Tajik MPC standards across all eleven sampling locations. Key findings by parameter are as follows.

Baljuvon-Sari Khosor: ESIA

or significant vehicle traffic along this route. Coli-index values were uniformly low, ranging from 16 to 155 pcs/litre, within the standard of 1,000 pcs/litre, confirming limited microbiological contamination under dry season conditions.

Dry residue (total dissolved solids) values were low to moderate, ranging from approximately 120 to 394 mg/l, well within the 1,000 mg/l standard and consistent with the low mineralisation character of this mountain river system. Electrical conductivity values were in the range of 130–180 $\mu\text{S}/\text{cm}$ for most locations, reflecting low ionic concentrations. These findings collectively indicate a river system that, under dry season low-flow conditions, is chemically clean and of good physico-chemical quality for most parameters.

Suspended Solids — Elevated Baseline Conditions - Suspended solids concentrations represent the most significant baseline water quality finding and require specific attention in the context of impact assessment. The Tajik MPC domestic use standard for suspended solids is 25 mg/l; the fishery designation standard is 75 mg/l. Against these thresholds, nine of the eleven sampling locations recorded suspended solids concentrations exceeding the domestic use standard, and one location recorded a value exceeding the fishery standard.

Table 28: Summary of Baseline Suspended Solids Results (July 2023)

Location	Suspended Solids (mg/l)	Domestic Standard (25 mg/l)	Fishery Standard (75 mg/l)
km 1, Surkhob	64.4	Exceeds	Within
km 20	59.1	Exceeds	Within
km 26, Bogisogon (S)	23.1	Within	Within
km 27, Bogisogon (N)	45.5	Exceeds	Within
km 31, Shahidon	41.2	Exceeds	Within
km 36, Dashtiturko	141.3	Exceeds	Exceeds
km 44, Surkhudara	67.5	Exceeds	Within
km 46, Peshtoba	61.2	Exceeds	Within
km 51	45.2	Exceeds	Within
km 54, Mullokoni	56.2	Exceeds	Within
km 56, Sari Khosor hotel	26.7	Exceeds	Within

Source: IEE (2025), Table 30.

The pattern of elevated suspended solids is consistent with the geomorphological character of the Shurobdaryo catchment described above. The river drains a tectonically active, highly erodible mountainous catchment with abundant exposed fine-grained and weathered material on valley sides. Bank erosion, slope wash, and sediment delivery from tributary channels are active and continuous processes in this setting, producing naturally elevated turbidity and suspended sediment loads that are a background condition of the river rather than a consequence of human activity.



The value recorded at km 36 (Dashtiturko) — 141.3 mg/l — is particularly notable, exceeding the fishery designation standard by nearly double. This location corresponds to a section of the corridor where the river is laterally active, valley slopes are steep and poorly vegetated, and tributary inputs contribute additional fine sediment loads. It likely represents a natural hotspot of elevated baseline turbidity associated with local geomorphological conditions rather than a point source of contamination.

It is important to note that the July 2023 measurements were collected during dry season low-flow conditions, when sediment transport is at its annual minimum. During the spring snowmelt and peak flow period (March–May), suspended sediment concentrations in the Shurobdaryo and its tributaries can be expected to be substantially higher than the July baseline values, consistent with the dynamics of similar mountain river systems. The baseline data therefore provides a conservative lower bound on ambient suspended solids rather than a representative annual mean or peak condition.

Data Gaps and Limitations - Several limitations of the July 2023 baseline dataset are noted:

- a) The sampling campaign did not include analysis of heavy metals (including aluminium, iron, cadmium, copper, nickel, lead, zinc, or chromium), which are included in the project's adopted water quality standards. Given the Project's works include in-channel and riverbank operations in a geologically active setting, a baseline heavy metals survey is recommended as part of the pre-construction monitoring programme to establish reference concentrations prior to construction.
- b) A data quality issue has been identified in the tabulated results for km 36 (Dashtiturko) in the IEE source document. The dry residue and pH values in the original table appear to contain formatting errors (pH recorded as 140.0, which is physically impossible). The suspended solids value of 141.3 mg/l for this location is considered reliable on the basis of consistency with the geomorphological setting, but the other parameter values for km 36 should be verified against the original laboratory report before being cited in the final ESIA.

Note: Updated pre-construction water quality measurements — including heavy metals — will be undertaken as part of the ESIA field monitoring programme and incorporated into this section in the final ESIA report.

Groundwater

Groundwater is present at shallow depth in sections of the corridor where the road alignment runs along the river floodplain. Groundwater levels recorded during the 2023 geotechnical surveys at seven excavation locations on the floodplain were encountered at depths of between 2.5 m and 3.0 m below ground level.²⁸ Groundwater was not encountered in the remaining excavation locations, which were investigated to the 3.0 m survey depth.

Groundwater is not directly abstracted along the corridor — there are no boreholes or wells in use for domestic or agricultural supply. Community water needs are met through natural spring discharge, which represents shallow groundwater emerging at the surface, and through direct surface water intakes from the Shurobdaryo and its tributaries.

Shallow groundwater on the floodplain sections has implications for excavation during construction and for the long-term stability of road embankments in these areas.

Water Use

²⁸ Kocks Consult / DITI (2023). Engineering-Geological and Geotechnical Survey Report — Baljuvon–Sari Khosor Road. PIURR, Ministry of Transport, Republic of Tajikistan.



Communities along the corridor rely on water from the river system for domestic supply and, in many cases, for irrigation of agricultural land. Irrigation channels drawing from tributary streams serve a number of land parcels adjacent to the road alignment.

6.1.9. Air Quality and Noise

The baseline air quality and noise environment along the BSK corridor reflects its setting: a remote, rural mountain valley with low traffic volumes, no significant industrial activity, and small scattered settlements. Neither air quality nor noise are among the more complex or sensitive aspects of the corridor baseline.

Air Quality

Air quality along the corridor is generally good. There are no major industrial emission sources in the area, and the low volume of traffic on the existing unpaved road means that vehicle exhaust emissions are negligible at a corridor scale. Instrumental baseline measurements of air quality were conducted at seven locations along the corridor between 22 and 23 July 2023, covering the full route from km 0 (Baljuvon) to km 54 (Mullokoni and the Sari Khosor hotel area) (IEE, 2025). Measurements were taken seven times over a 24-hour period at each location and assessed against Tajikistan's maximum allowable concentrations (MACs) for seven pollutants. Average values across all measurement locations are summarised in Table 29 below.

Table 29: Summary of Baseline Air Quality Measurements — Average Values by Location (July 2023)

Pollutant	Tajik MAC (mg/m ³)	km 0 Baljuvon	km 2 Unpaved section	km 18 Dashtiturko	km 31 Shahidon	km 47 Peshtoba	km 54 Mullokoni	km 54 Sari Khosor hotel	Corridor average
PM ₁₀	0.30	0.060	0.052	0.049	0.072	0.071	0.061	0.048	0.059
PM _{2.5}	0.16	0.016	0.020	0.024	0.054	0.045	0.029	0.018	0.030
NO ₂	0.04	0.005	0.003	0.006	0.007	0.007	0.006	0.003	0.005
SO ₂	0.50	0.004	<0.001	0.001	0.001	0.001	<0.001	<0.001	0.001
CO	3.0	1.20	0.97	0.88	1.06	0.90	0.14	0.13	0.75
NO	0.06	0.003	0.001	0.004	0.006	0.004	0.001	0.001	0.003
Dust (TSP)	0.15	0.012	0.016	0.081	0.084	0.063	0.057	0.051	0.052

Source: IEE (2025), instrumental measurements conducted 22–23 July 2023. Values are averages across seven measurement periods per location (04:00–23:00). All values below applicable Tajik MAC standards.

[illegible]

Baljuvon-Sari Khosor: ESIA

All recorded values were below the applicable Tajik standards at all seven locations. No exceedances were recorded for any pollutant. The highest dust readings were observed in the middle sections of the corridor — at Dashtiturko (km 18) and Shahidon (km 31) — consistent with the unpaved road surface and more active vehicle movement in these areas. CO values were higher in the lower and mid-corridor sections where traffic activity is marginally greater, though all remained well below the standard of 3.0 mg/m³.

The dominant existing source of air emissions is dust from the unpaved road surface. On dry and windy days — particularly during summer — vehicle movements generate localised dust that affects the road surface and the immediately adjacent area, most noticeably near settlements and on steeper sections. A secondary source is domestic burning of solid fuel for heating and cooking in settlements during winter months, which is a normal background condition for rural communities in this region.

Note: Updated instrumental air quality measurements will be undertaken as part of the ESIA field programme to establish a current pre-construction baseline. Results will be incorporated into this section in the final ESIA report.

Noise and Vibration

The baseline noise environment is quiet. The corridor runs through open mountain valley terrain with no significant continuous noise sources, and the combination of low traffic volumes, sparse settlement, and natural sounds — wind, flowing water, and the river — defines the ambient acoustic character of most of the route.

Instrumental baseline noise measurements were conducted at six locations along the corridor over 24 hours on 22 and 23 July 2023, with readings taken at eight time intervals across the day and night (IEE, 2025). Results are summarised in the table below, assessed against Tajikistan's sanitary noise standards (SN 2.2.4/2.1.8.562-96), which set limits of 55 dB(A) daytime and 45 dB(A) night-time for residential zones.

Table 30: Baseline Noise Measurement Results (July 2023)

No.	Location	Daytime standard dB(A) (07:00–23:00)	Night-time standard dB(A) (23:00–07:00)	Measured values dB(A) by time period							
				07:00	10:00	13:00	16:00	19:00	23:00	02:00	07:00
1M	km 0, Baljuvon	55	45	41.7	45.2	42.1	44.0	40.1	42.0	37.6	41.8
2M	km 18, Dashtiturko	55	45	42.5	43.7	44.0	43.2	38.9	40.7	37.2	41.2
3M	km 31, Shahidon	55	45	41.1	42.8	44.2	43.6	40.4	39.5	38.0	40.6
4M	km 47, Peshtoba	55	45	41.4	41.8	43.9	42.5	37.9	39.0	36.7	40.8
5M	km 54, Mullokoni	55	45	42.2	42.0	43.7	42.3	40.0	39.1	38.8	40.9
6M	km 54, Sari Khosor hotel	55	45	43.5	42.8	43.9	42.6	40.0	39.2	38.9	41.0



Source: IEE (2025), instrumental measurements conducted 22–23 July 2023, assessed against Tajikistan sanitary norms SN 2.2.4/2.1.8.562-96 (residential zone standards). Measurements conducted at atmospheric pressure 679–680 mmHg, wind speed 1–7 m/s, humidity 25–35%, temperature 27–35°C.

Recorded noise levels were consistently low across all locations and time periods, with readings generally in the range of 37–45 dB(A). All measurements were within the applicable daytime and night-time standards. The IEE (2025) notes that the Sari Khosor hotel location recorded a slight exceedance of the night-time standard at one measurement interval; this is likely attributable to the proximity of the river rather than anthropogenic sources, and does not represent a baseline concern. There are no significant sources of ground-borne vibration along the corridor under current conditions.

Note: Updated instrumental noise and vibration measurements will be undertaken at sensitive receptor locations — including residential dwellings, schools, and community facilities — as part of the ESIA field programme.

6.2. Biological Environment

6.2.1. Habitats and Land Cover

The Project area encompasses a mosaic of natural, semi-natural, and modified habitats shaped by mountainous terrain, river valleys, and long-standing human land use. Land cover along the corridor is strongly influenced by elevation, slope gradient, proximity to watercourses, and existing infrastructure, resulting in pronounced contrasts over short distances.

Natural and semi-natural habitats are primarily associated with riverine and riparian environments along the main Shurobdaryo channel and tributary drainage features. These areas include riverbanks, floodplain zones, gravel bars, and seasonal channels, which support comparatively denser vegetation than surrounding slopes. However, riparian habitats are often narrow, discontinuous, and seasonally variable, reflecting high flow energy, sediment movement, and periodic flooding associated with snowmelt and intense rainfall. The river bed is highly braided and dynamic; in the northern and southern sections of the project it can be up to approximately one kilometre wide, narrowing to around 50 m in the central area.

Away from watercourses, slopes and hillsides are characterised by sparse and patchy vegetation cover. Steep gradients, shallow and erodible soils, active erosion, and exposure to geomorphological processes limit vegetation development. These areas are typically dominated by grassland, low shrub cover, or degraded natural vegetation, with frequent bare ground and rock outcrops visible on steeper sections and cut slopes.

Large sections of the corridor pass through modified and highly disturbed habitats, including the existing road formation, roadside embankments, cut-and-fill slopes, agricultural land, pasture, and areas influenced by settlements and vehicle access. Vegetation in these areas is fragmented and regularly disturbed by traffic, erosion, maintenance activities, and grazing. As a result, these habitats generally exhibit lower ecological sensitivity compared to intact riparian zones, while remaining vulnerable to further disturbance.

Habitat mapping is presented in Figure 22 to Figure 26 (within a 1 km buffer of the corridor). The following table summarises the major land cover types within this buffer based on ESA WorldCover 2021 data.

Table 31: Land Cover Types within 1 km Buffer of the Project Corridor

Habitat / Land Cover Type	Area (ha)	Percentage (%)
Grassland	3,715.32	43.1
Bare / sparse vegetation	2,835.84	32.9

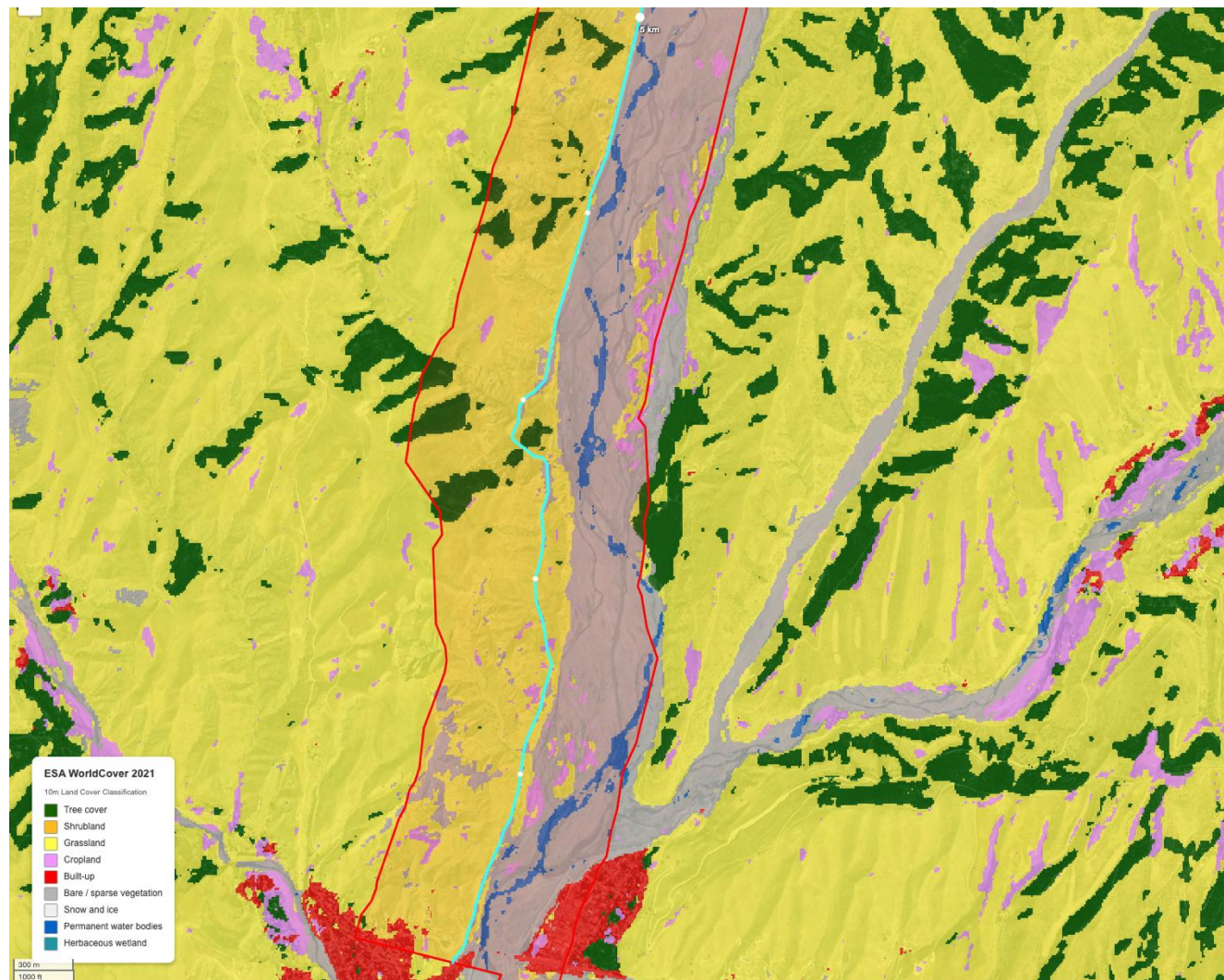


Cropland	940.40	10.9
Tree cover	869.80	10.1
Permanent water bodies	221.18	2.6
Built-up	40.50	0.5
Shrubland	0.62	< 0.1
TOTAL	8,623.66	100.0

Source: ESA WorldCover 2021

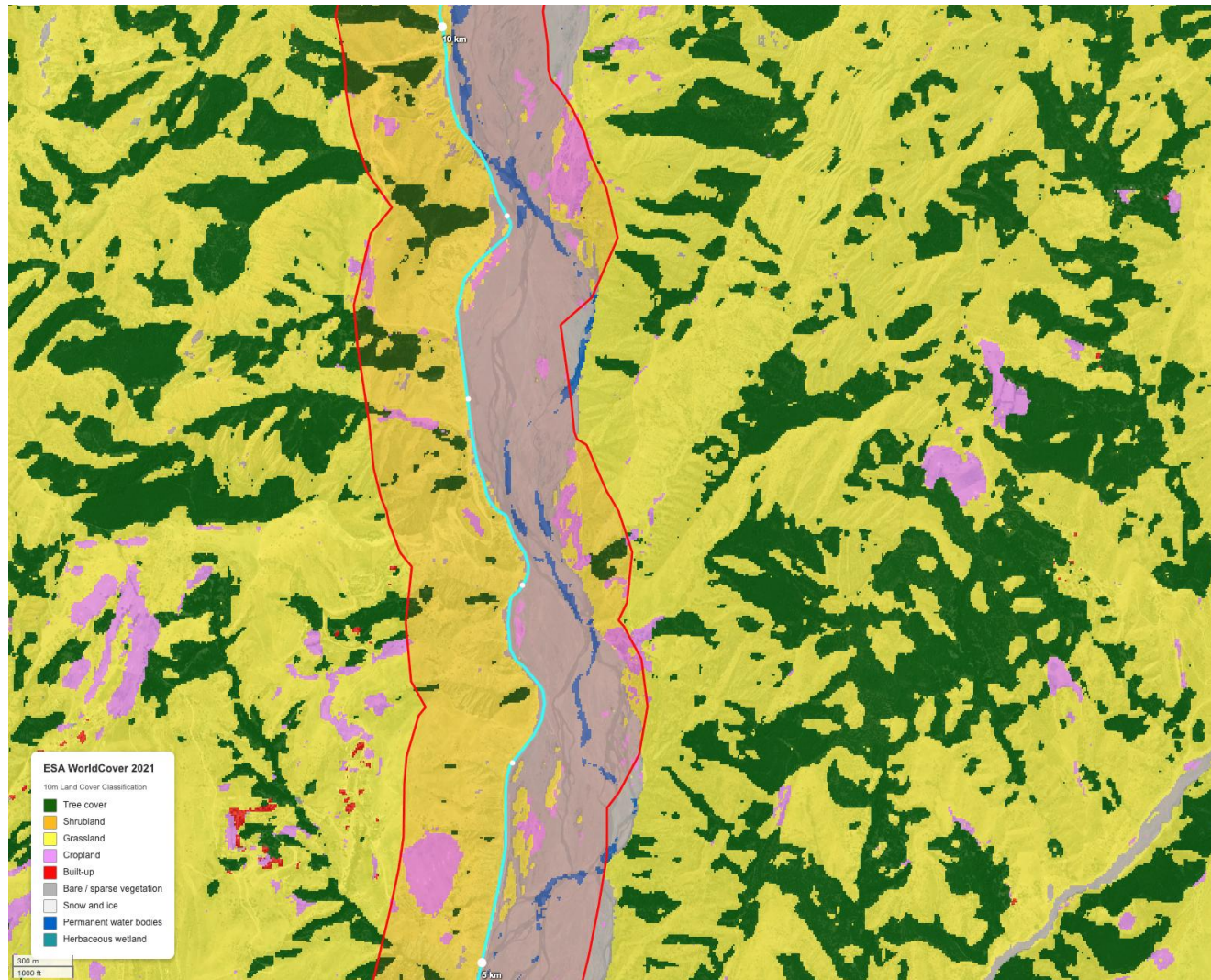
Overall, habitat quality and ecological sensitivity vary markedly along the corridor, with the highest potential ecological value associated with the limited riparian strip along the Shurobdaryo and the lowest associated with steep, eroded slopes and existing road infrastructure.

Figure 23: Habitat Mapping, KM0-KM 5



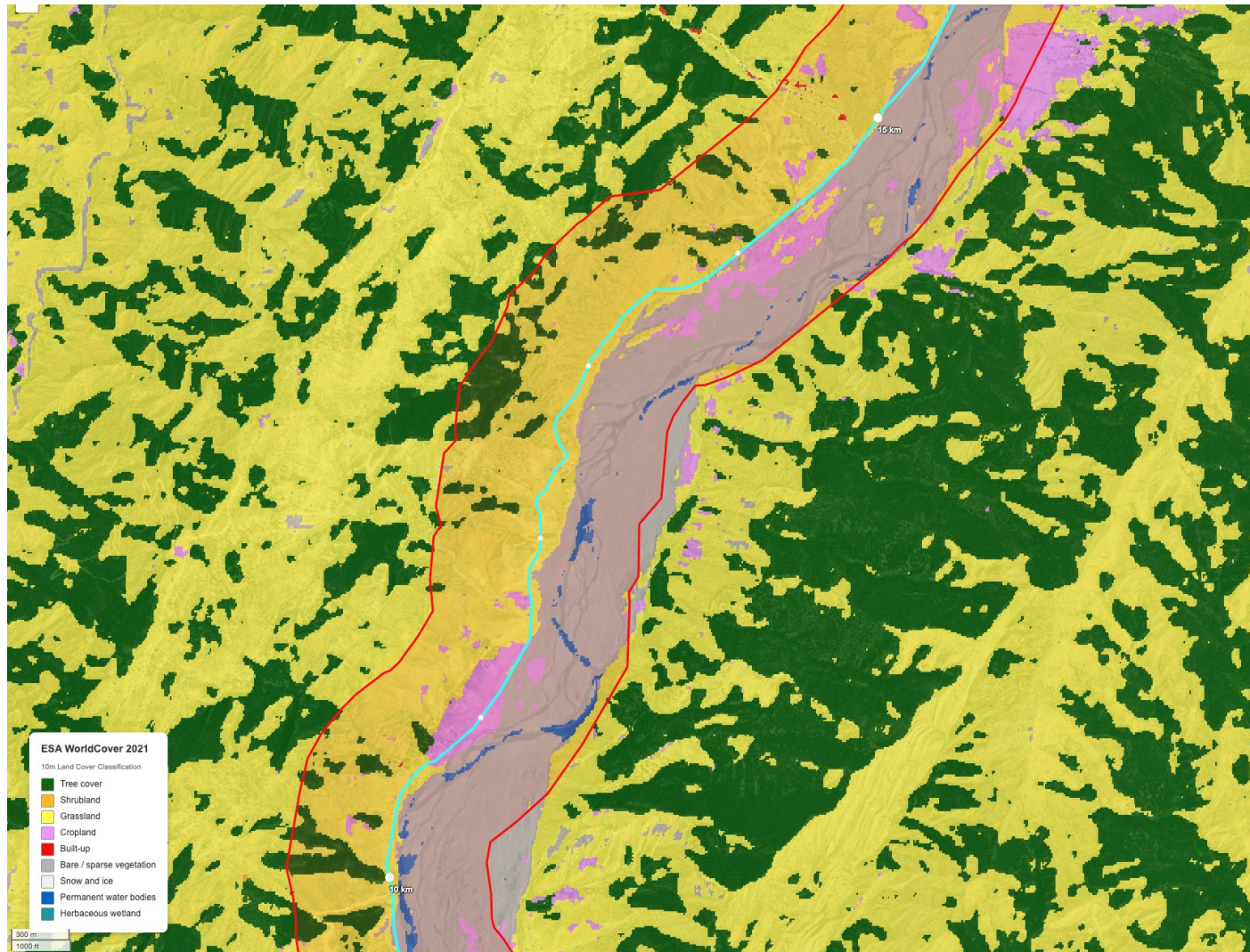
Source: ESA WorldCover 2021 (habitat Classification) / Google Earth

Figure 24: Habitat Mapping, KM 5-KM 10



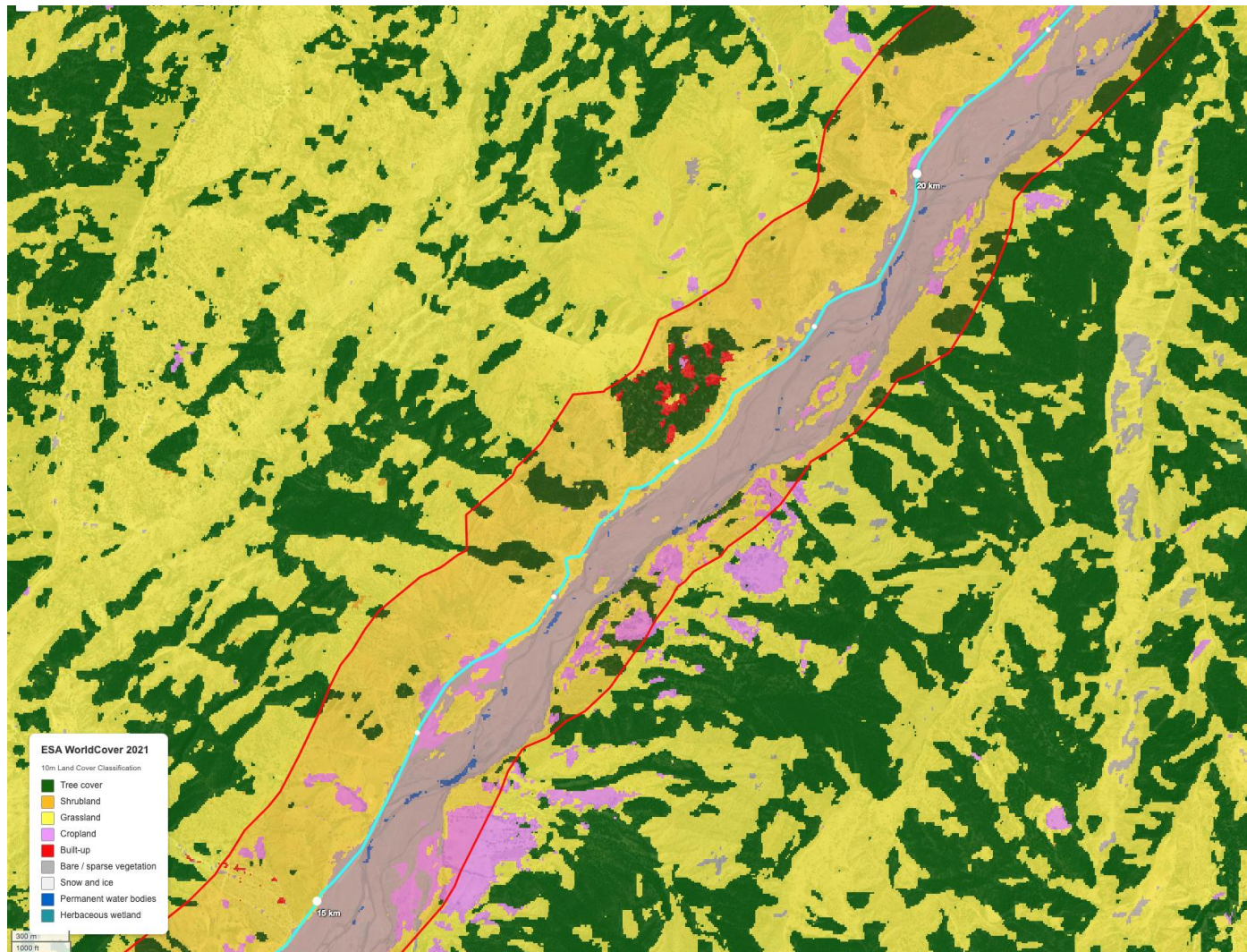
Source: ESA WorldCover 2021 (habitat Classification) / Google Earth

Figure 25: Habitat Mapping, KM 10-KM 15



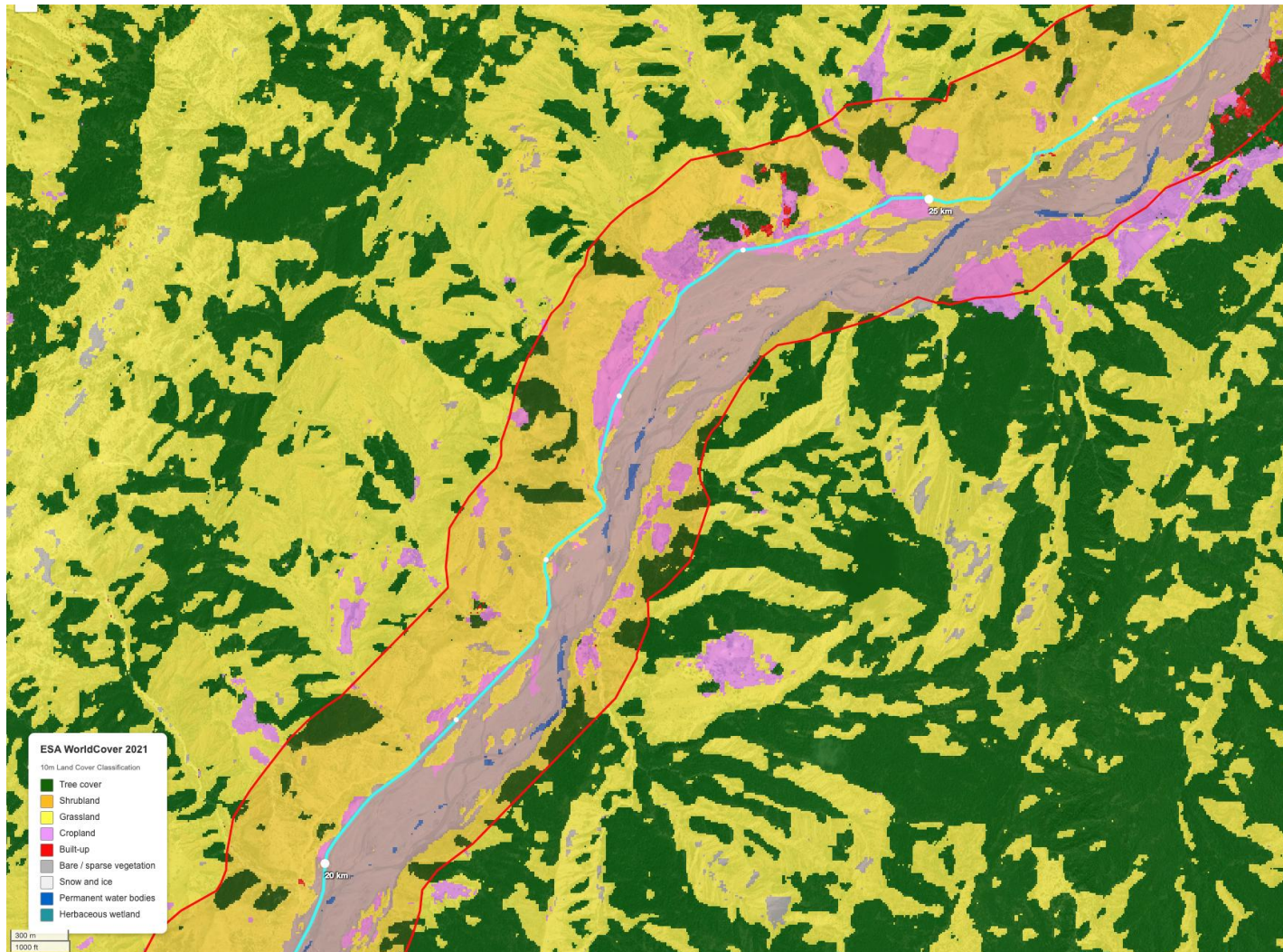
Source: ESA WorldCover 2021 (habitat Classification) / Google Earth

Figure 26: Habitat Mapping, KM 15-KM 20



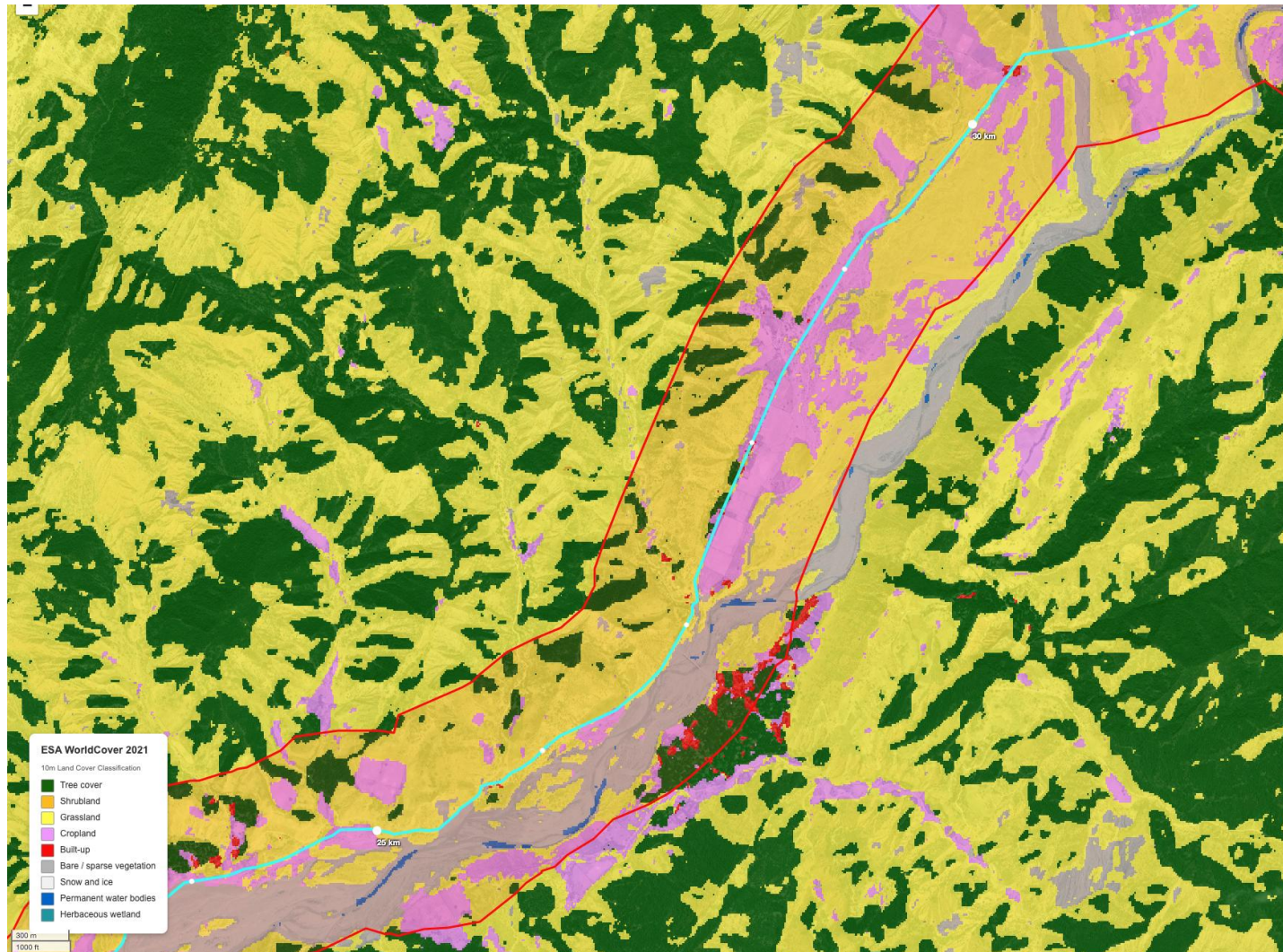
Source: ESA WorldCover 2021 (habitat Classification) / Google Earth

Figure 27: Habitat Mapping, KM 20-KM 25



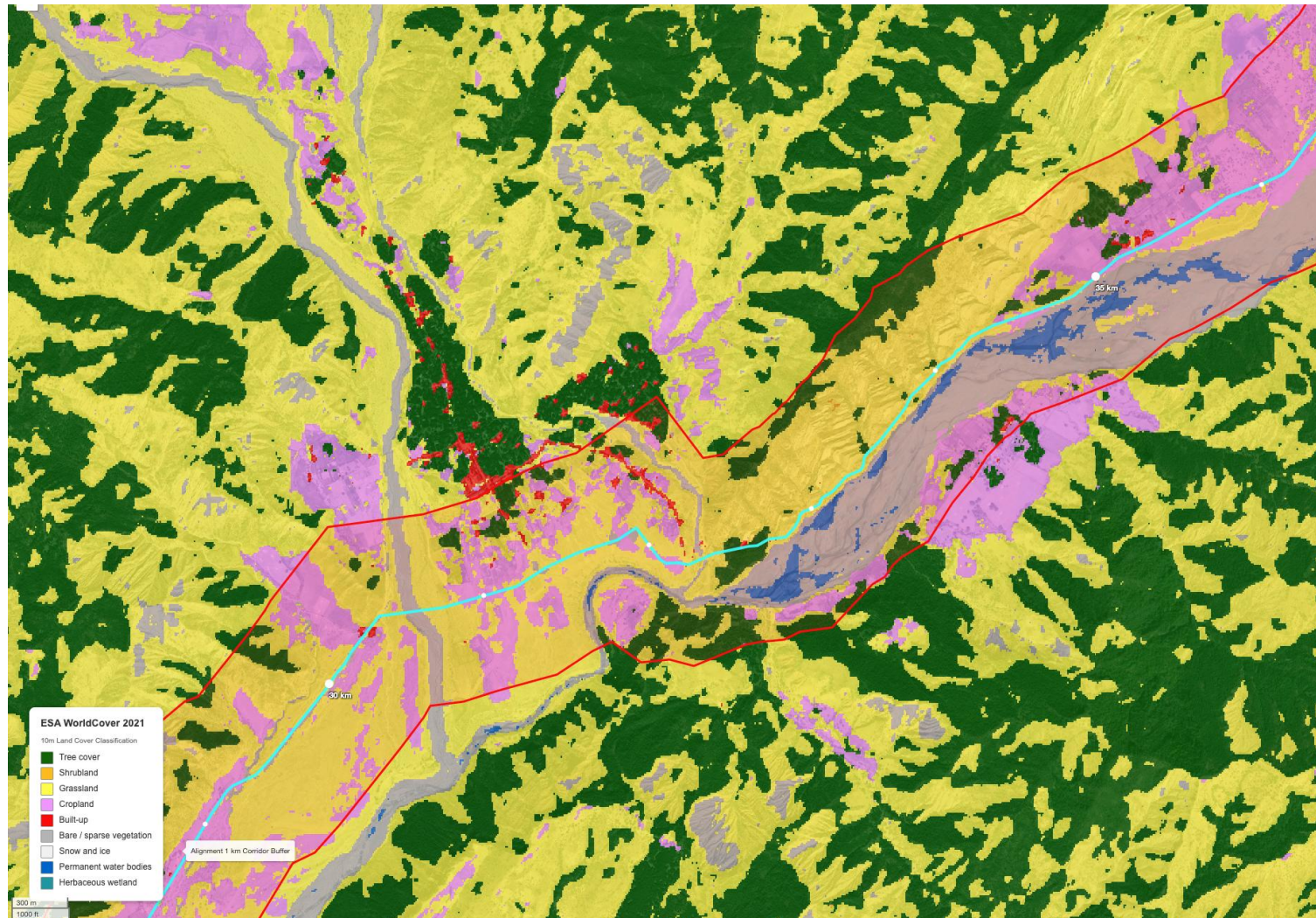
Source: ESA WorldCover 2021 (habitat Classification) / Google Earth

Figure 28: Habitat Mapping, KM 25-KM 30



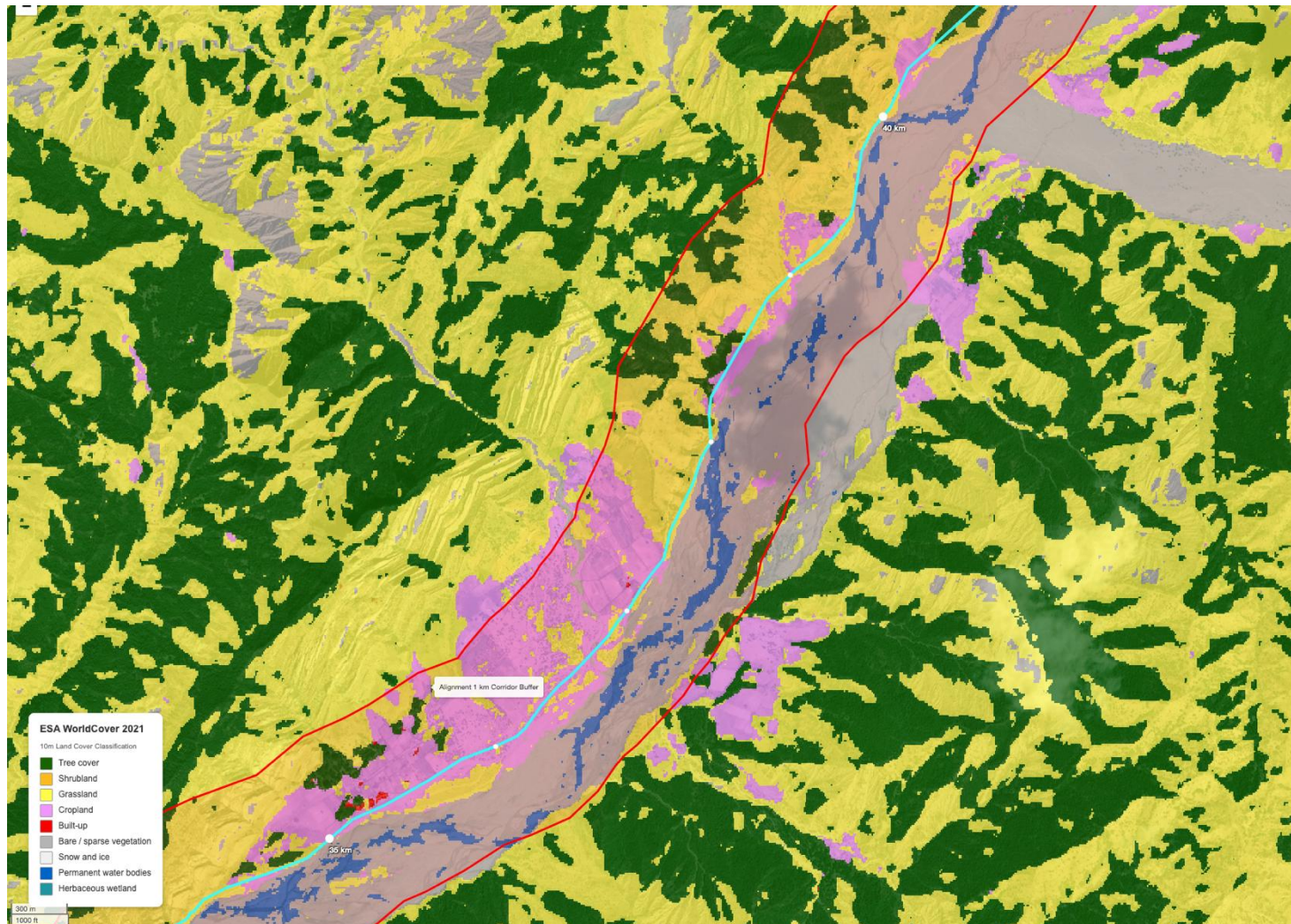
Source: ESA WorldCover 2021 (habitat Classification) / Google Earth

Figure 28: Habitat Mapping, KM 30 -KM 35



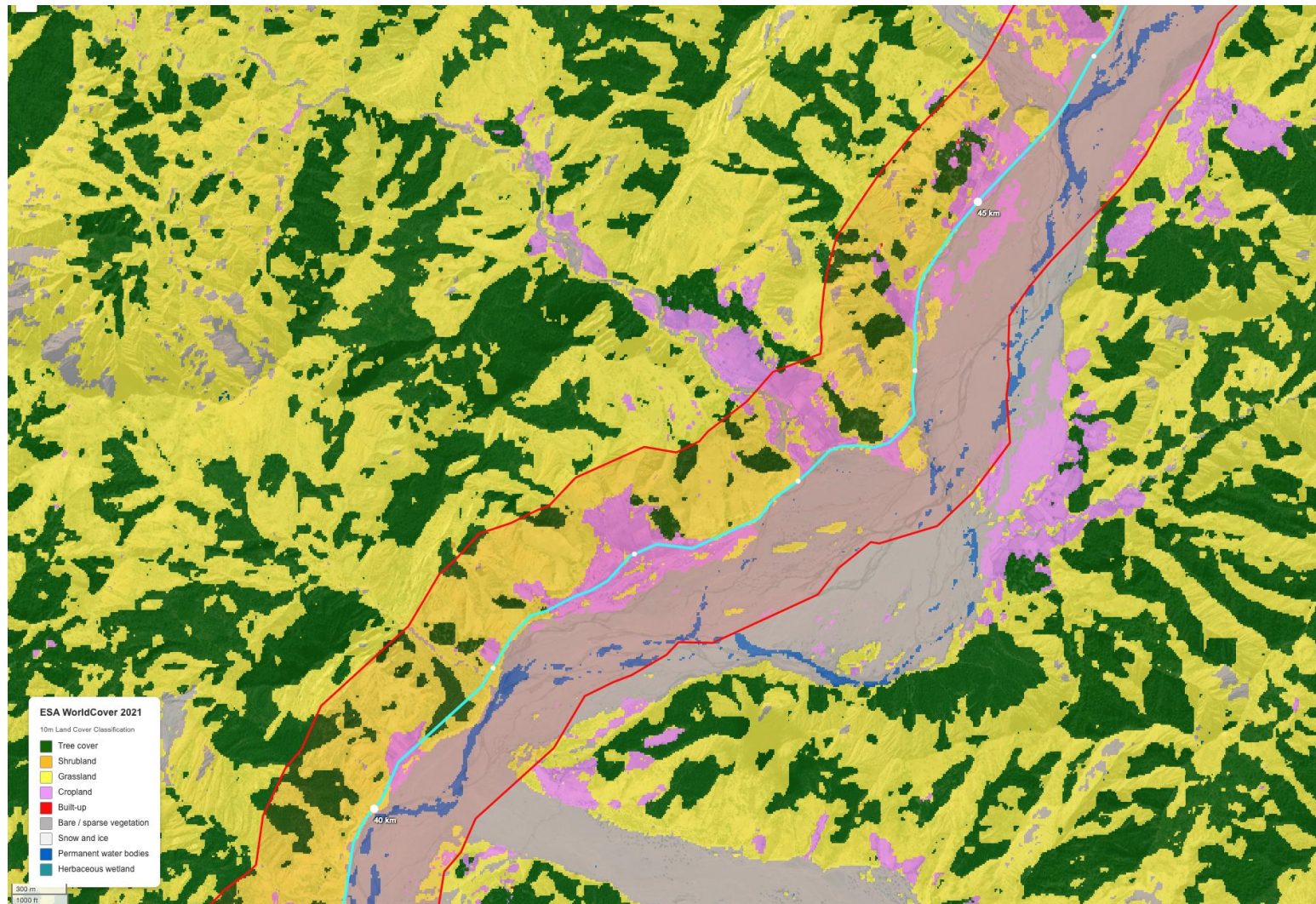
Source: ESA WorldCover 2021 (habitat Classification) / Google Earth

Figure 29: Habitat Mapping, KM 35-KM 40



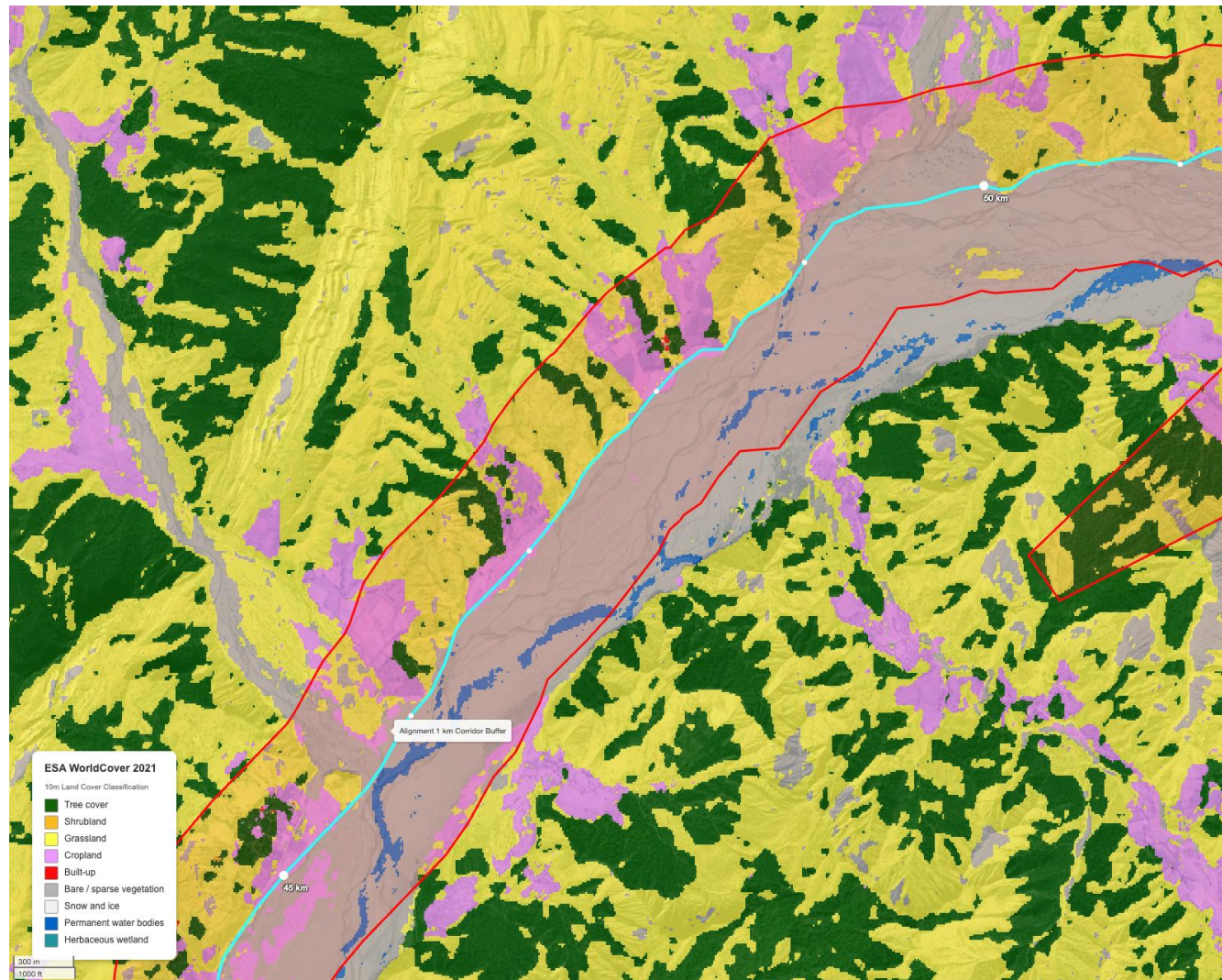
Source: ESA WorldCover 2021 (habitat Classification) / Google Earth

Figure 30: Habitat Mapping, KM 40-KM 45



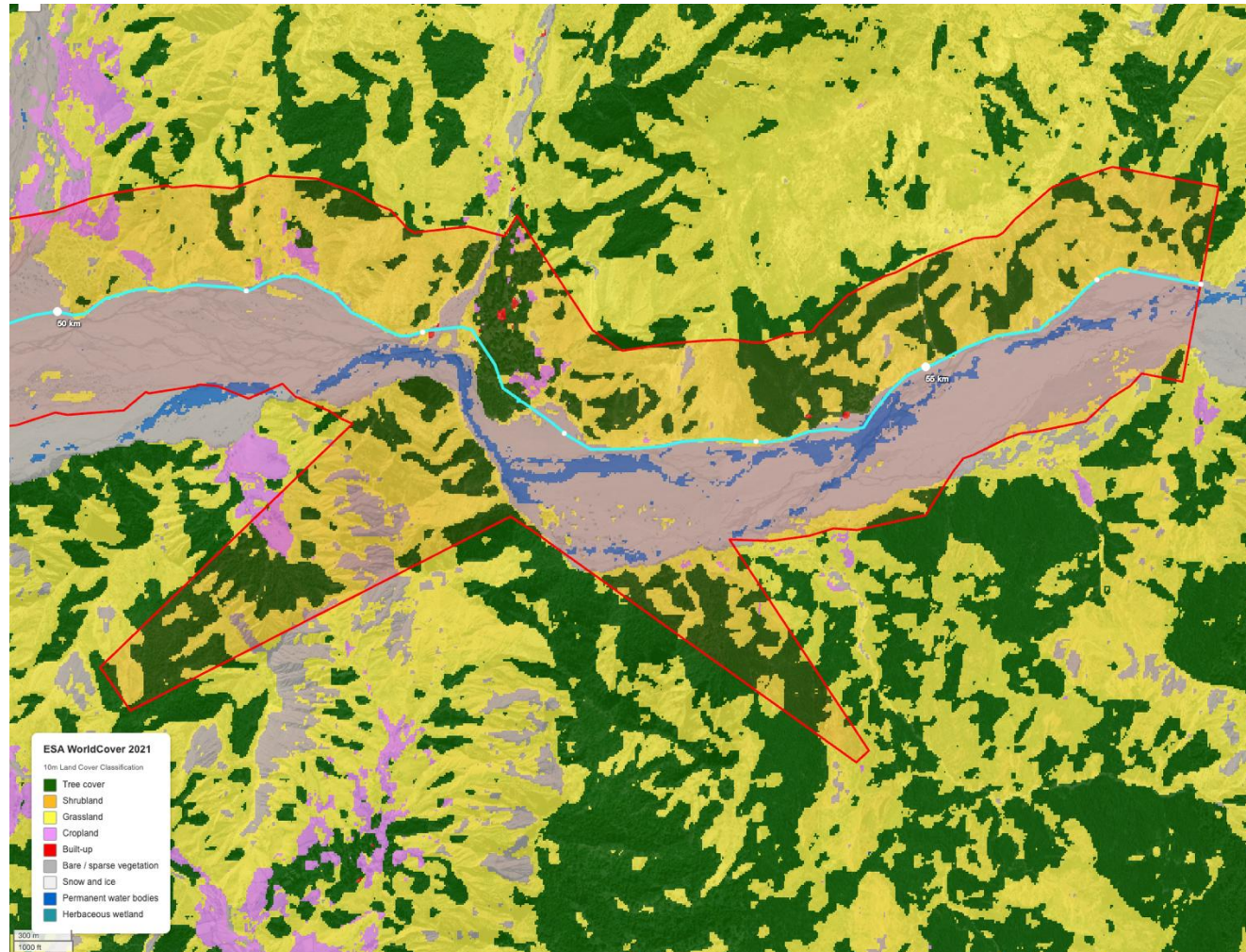
Source: ESA WorldCover 2021 (habitat Classification) / Google Earth

Figure 31: Habitat Mapping, KM 45-KM 50



Source: ESA WorldCover 2021 (habitat Classification) / Google Earth

Figure 32: Habitat Mapping, KM 50-KM 56



Source: ESA WorldCover 2021 (habitat Classification) / Google Earth



Natural Vegetation of the Wider Area - The broader Sari Khosor area supports a diverse mosaic of vegetation communities reflecting the complex terrain, geology, and altitudinal variation of the South-Western Natural Province of Tajikistan. A desk-based biodiversity assessment commissioned for the project (Latifi, 2026) identified the following vegetation types likely to be present within the wider area along the project corridor:

- Broadleaf forests — formed by thermophilic species including walnut (*Juglans regia*), maple (*Acer turkestanicum*), plane tree (*Platanus orientalis*), and wild apple (*Malus sieversii*);
- Mesophilic deciduous shrub communities (800–2,800 m asl) — ecologically similar to broadleaf forests and distributed throughout mid-mountain and upper foothill zones; characteristic species include wild roses (*Rosa* spp.), *Aflatus ulmifolia*, and *Exochorda alberti*;
- Poplar forests (800–3,000 m asl) — dominated by *Populus bachofenii*, *P. tadshikistanica*, and *P. konjilaliana*, together with *Fraxinus sogdiana*, *Hippophae rhamnoides*, and *Salix* spp.;
- Tugai forest communities (500–1,600 m asl) — characteristic Central Asian floodplain formations of *Elaeagnus angustifolia*, *Tamarix* spp., and *Hippophae rhamnoides*; these are unlikely to be present within the project corridor given the confined montane character and elevations of 1,200–2,000 m;
- Sparse woodlands (*shiblyak*) (800–1,600 m asl) — xerophytic scrub dominated by pistachio (*Pistacia vera*), almond (*Amygdalus bucharica*), hackberry (*Celtis caucasica*), and hawthorn (*Crataegus* spp.);
- Juniper forests (1,200–3,000 m asl) — represented by *Juniperus seravshanica*, often associated with *Acer turkestanicum*;
- Herbaceous communities (800–2,000 m asl) — perennial grasses and semi-shrubs;
- Semi-savannas (800–1,400 m asl) — hemixerophytic grasses and forbs;
- Meadow vegetation (2,400–3,000 m asl) — perennial grasses and forbs of higher altitudinal zones;
- Cushion plant communities (1,000–4,000 m asl) — high-altitude cold-resistant vegetation.

Within the project corridor itself, the vegetation is largely represented by the modified and degraded end of this spectrum — disturbed grassland, bare ground, roadside embankments, and fragmented riparian scrub (principally poplar-willow and sea buckthorn growth along the Shurobdaryo banks). The more structurally diverse natural vegetation types are found on the adjacent valley slopes and in the tributary catchments away from the existing road alignment.

Critical Habitat Assessment

Purpose and Regulatory Basis - As a Category A project under the EBRD's Environmental and Social Policy, the project is subject to EBRD Environmental and Social Requirement 6 (ESR6, 2024), which requires a Critical Habitat Assessment (CHA) to determine whether the project area or its zone of influence constitutes Critical Habitat (CH) or contains Priority Biodiversity Features (PBFs). The CHA has been prepared in accordance with ESR6 and its associated Guidance Note (EBRD, 2025), and is presented in full as Annex D of this ESIA.

Methodology and Study Area - The CHA was conducted in three stages: baseline establishment, assessment against EBRD criteria, and impact assessment with mitigation. The Ecologically Appropriate Area of Analysis (EAAA) was defined to encompass the full length of the road alignment within the Shurobdaryo valley, the adjacent valley side slopes, and connecting tributary catchments, extending sufficiently north and south to capture potential upstream and downstream ecological relationships and the movement ranges of wide-ranging species. This boundary also captures the



location of the Sari Khosor Natural Park (approximately 5 km from the road corridor, as confirmed by the Committee on Environmental Protection) and the Dangara Massif Key Biodiversity Area (located within the 50 km buffer).

Data collection drew on the following primary sources:

- IBAT PS6 biodiversity risk screen (February 2026), generating a long list of 412 species potentially present within the 50 km study area based on the IUCN Red List;
- Desk-based biodiversity assessment of the Sari Khosor area (Latifi, 2026), providing a comprehensive species inventory and vegetation type characterisation for the region;
- Aquatic biology field survey (Shamsiddinov, 2025), involving sampling at four points along the project river corridor for fish, benthos, and water quality;
- Early-season terrestrial field surveys (March 2026), including botanical and faunal route surveys along the corridor, noting that March represents an early point in the vegetation and wildlife activity season and results are considered preliminary;
- Official correspondence from the State Institution for Specially Protected Natural Territories (December 2024), confirming the location and distance of Sari Khosor Natural Park and the presence of a Bukhara Deer (*Cervus hanglu bactrianus*) breeding facility at Dashtaro village near km 35;
- UNEP-WCMC Protected Planet database and IUCN Red List (v2025-2).

The CHA assessed habitats, ecosystems, and species against the five EBRD ESR6 criteria for Critical Habitat: (i) threatened species, (ii) restricted-range or endemic species, (iii) migratory or congregatory species, (iv) highly threatened or unique ecosystems, and (v) areas associated with key evolutionary processes. PBF criteria were assessed in parallel, using Annex 1 of the Bern Convention Revised Resolution 6 as the applicable instrument for Tajikistan (a Bern Convention signatory but not an EU member state). A precautionary approach was applied throughout where data were incomplete.

Outcome: Critical Habitat Determination - The CHA concluded that no Critical Habitat is present within the EAAA under any of the five ESR6 criteria. The key findings by criterion are summarised below.

Criterion 1 — Threatened Species: Of the 24 threatened species (4 CR, 5 EN, 15 VU) identified in the IBAT long list, none were found to qualify the EAAA as Critical Habitat. The EAAA is not considered to support five or more reproductive units of any CR or EN species, nor to hold 0.5% or more of the global population of any qualifying species. Two critically endangered sturgeons (*Pseudoscaphirhynchus* spp.) have not been recorded in the project river system. National Red List CR and EN species are not present within the EAAA in concentrations constituting a nationally important aggregation.

Criterion 2 — Endemic or Range-Restricted Species: Latifi (2026) records 147 endemic plant species in the wider Sari Khosor area, reflecting the biogeographic character of the South-Western Natural Province rather than a concentration unique to the road corridor. Two Tertiary relict species (*Ostrowskia magnifica* and *Petilium eduardii*) occur in the wider area across multi-country distributions. The EAAA is not considered to hold 10% or more of the global population of any endemic or range-restricted species. The project involves rehabilitation of a long-disturbed road alignment and the works footprint does not extend into the undisturbed mountain slopes where relict species are most likely concentrated.

Criterion 3 — Migratory and Congregatory Species: No habitat is present within the EAAA that regularly supports 1% or more of the global population of any migratory or congregatory species. Habitats used by passage waders and waterfowl (estuaries, large lakes, wetlands) are absent from the corridor. The Shurobdaryo supports a confirmed autumn spawning migration of Amu Darya Trout, documented by the Shamsiddinov (2023) aquatic survey; while the global population of this species is not quantified with sufficient precision to determine whether the EAAA holds 1% of the global



population, this seasonal spawning aggregation is treated as a Priority Biodiversity Feature under the migratory species pathway (see below).

Criterion 4 — Highly Threatened or Unique Ecosystems: No habitat types present within the EAAA are listed as Priority Habitats under Annex 1 of the EU Habitats Directive, nor are any ecosystems within the EAAA assessed as Critically Endangered or Endangered under the IUCN Red List of Ecosystems. Classic lowland tugai — a priority floodplain ecosystem at the Central Asian scale — is unlikely to be present within the project corridor at elevations of 1,200–2,000 m and with confined, montane river morphology. No habitats qualify as Critical Habitat under this criterion.

Criterion 5 — Key Evolutionary Processes: The high level of plant endemism recorded by Latifi (2026) reflects the broader biogeographic character of the South-Western Natural Province. The project involves rehabilitation of an existing, long-disturbed road alignment, and the direct footprint does not extend into the undisturbed mountain habitats where evolutionary processes underpinning endemism are concentrated. This criterion is not triggered at the scale and footprint of this project.

The Biodiversity Management Plan (BMP), which translates the CHA mitigation commitments into contractor-level operational requirements, is presented as part of the ESMP.

Priority Biodiversity Features

The CHA identified a number of Priority Biodiversity Features (PBFs) within the EAAA. PBFs are species, habitats, or ecological processes of particular conservation significance that are at risk from project activities, and their identification triggers a no-net-loss obligation under EBRD ESR6.

Two habitat types were identified as PBFs:

- C3.62 Unvegetated River Gravel Banks — present within the Shurobdaryo channel throughout the project corridor;
- C3.55 Sparsely Vegetated River Gravel Banks — present within the Shurobdaryo channel, though the precise species composition differs from the Bern Convention habitat description.

These gravel bank habitats are assessed as PBFs on the basis of their listing in the Bern Convention habitat classification. The riparian bankside vegetation present along the corridor — predominantly fragmented poplar-willow scrub and sea buckthorn — does not itself meet the threshold for PBF designation, but provides important supporting habitat for PBF species including Eurasian Otter and Amu Darya Trout; its protection is addressed through the bankside clearance minimisation and riparian reinstatement measures in the BMP.

A total of 19 species were identified as PBFs through the CHA process. Six species qualify as PBFs under IUCN Red List criteria:

- Marbled Polecat (*Vormela peregusna*, VU)
- Eastern Imperial Eagle (*Aquila heliaca*, VU)
- Tulipa praestans (VU)
- Tulipa anisophylla (VU)
- Urial (*Ovis vignei*, VU)
- Yellow-eyed Pigeon (*Columba eversmanni*, VU)

Thirteen further species qualify as PBFs through their listing as CR or EN in the national Red Data Book of the Republic of Tajikistan (2024), including Eurasian Otter (*Lutra lutra*, EN), Eurasian Lynx (*Lynx lynx isabellinus*, EN), Snow Leopard (*Panthera uncia*, EN), Tien Shan Brown Bear (*Ursus arctos isabellinus*, EN), Bukhara Urial (*Ovis vignei bochariensis*, CR), Saker Falcon (*Falco cherrug coatsi*, EN), Egyptian Vulture (*Neophron percnopterus*, EN), Bearded Vulture (*Gypaetus barbatus*, EN), Barbary Falcon (*Falco pelegrinoides*, EN), European Glass Lizard (*Pseudopus apodus*, EN nationally — note: listing in



the 2024 Red Data Book update requires confirmation), and four nationally-listed invertebrate species. The Bukhara Deer (*Cervus hanglu bactrianus*, CR) breeding facility at Dashtaro village (km 35) represents an additional confirmed PBF receptor adjacent to the road corridor. The Amu Darya Trout, spawning migration is treated as a PBF under the migratory species pathway.

The PBF species and the habitats in which they occur are discussed further in Section 6.2.2 (Flora) and Section 6.2.3 (Fauna). The project's obligations in relation to PBFs, including the no-net-loss requirement and the mitigation hierarchy, are set out in the impact assessment (Section 7) and the BMP.

6.2.2. Protected Areas

No nationally designated protected areas are directly intersected by the Project alignment or located within the immediate road corridor. The road follows existing disturbed terrain within the Shurobdaryo valley throughout its length.

The most significant protected area in the vicinity of the Project is the Sari Khosor Nature Park. The Nature Park is classified as a second-tier protected area under Tajikistan's eight-tier system of specially protected natural territories, established under the Law on Natural Territories and Specially Protected Objects. There are three State Nature Parks in Tajikistan in total, of which Sari Khosor is one. The Park was established by Government Decree No. 475 of 25 October 2005, covers an area of 3,805 hectares, and is managed by the Committee on Environmental Protection (CEP) under the Government of the Republic of Tajikistan.

According to the IUCN classification system, the Sari Khosor Natural Park is designated as a Category II protected area (regulated protected area), intended for the protection of biological diversity and the organisation of tourism. This designation carries specific legal protections and a special conservation regime under national law. It should be noted that the IBAT database records the Park under IUCN Category IV; however, Government Decree No. 475 (2005) establishes it as a Nature Park equivalent to IUCN Category II, and this is the operative classification used throughout this ESIA and the CHA.

The Sari Khosor Nature Park is located in the administrative territory of Sari Khosor Village, in Baljuvon District of Khatlon Region. From a botanical-geographical perspective, the territory belongs to the Hisoru-Darvaz province and encompasses the slopes of the Vakhsh mountain range and the upper parts of the Shurab, Obi-Mazar, and Yohsu river valleys. The altitude of the Park ranges from 1,500 to 3,000 m above sea level, with the main site situated between 1,800 and 2,960 m.

The precise location and distance of the Nature Park from the Project alignment were confirmed by the Committee on Environmental Protection (CEP) in an official letter dated December 2024 (see Annex E). The CEP confirms that the Nature Park is located in Baljuvon District and lies at a distance of 5 km from the BSK road alignment. The Park is an object of specially protected natural areas subject to a special protection regime.

The IEE (2025) further confirms that the Park is located up a side valley at approximately km 52 of the alignment, in an enclosed upland catchment. The Project does not enter the Nature Park, and no construction works are proposed within or adjacent to its boundaries.

Figure 33: The Shurkhob River looking south from Sari Khosor Natural Park (Source: Sari Khosor Natural Park documentation)



A map of the Sari Khosor Natural Park boundary is presented below (Figure 34). The map shows the Park situated in an upland catchment to the north of the road corridor terminus, separated from the valley through which the road runs by intervening ridgelines and terrain.

Figure 34: Map of Sari Khosor Natural Park boundary (Source: Sari Khosor Natural Park documentation). The road corridor is located to the south of the Park boundary



A review of the Integrated Biodiversity Assessment Tool (IBAT) identifies the Sari Khosor Park in the wrong location. The IBAT mapping error has no bearing on the assessment: the Park's confirmed location, boundaries, and ecological character as described in this section form the basis for all ESIA impact assessment relating to this designated area.

The Nature Park is characterised by the diversity of its natural ecosystems, its colourful flora and fauna, and the presence of numerous springs and water features. Vegetation is structured into four elevational zones:

- **Drought-resistant zone (1,000–1,800 m):** Cypress (*Celtis caucasica*), Bukhara almond (*Amygdalus bucharica*), maple (*Acer regelii*), hawthorn (*Crataegus pontica*), pistachio (*Pistacia vera*), and associated shrubs including rose (*Rosa*), barberry (*Berberis*), and fig (*Ficus carica*).
- **Broadleaved forest zone (Yalangazor Paunbarg, 1,800–2,600 m):** Turkestan maple (*Acer turkestanica*), Greek walnut (*Juglans regia*), Sievers apple (*Malus sieversii*), Oriental plane (*Platanus orientalis*), birch (*Betula* spp.), and poplar (*Populus tajikistani*). This zone represents the core broadleaved forest habitat that the Park was established to protect.
- **Juniper zone (Archzor, 1,500–3,000 m):** Two species of juniper — *Juniperus seravschanica* and *Juniperus semiglobosa* — both endemic to Central Asia and present since the Cretaceous period.
- **Subalpine zone (2,800–3,000 m):** Approximately 350 species of vascular plants, including medicinal and fodder species, *Eremurus magnifica*, *Paeonia magnifica*, mountain onions, several tulip species, and other rare taxa.

The Park supports a diverse and ecologically significant fauna. Key species recorded within the Park are summarised in the table below. Species assessments reflect IUCN Red List status (v2025-2) and the Red Data Book of the Republic of Tajikistan (2024 edition). Where species are identified as Priority Biodiversity Features (PBFs) under the project CHA, this is noted.

Table 32: Notable Species Present within sari Khosor Park

Species (Common Name)	Scientific Name	IUCN Status	Population Trend	Tajik Red Book Status	Notes
Snow leopard	<i>Panthera uncia</i>	VU	Decreasing	EN	Flagship species;
Urinal (Bukhara)	<i>Ovis vignei</i>	VU	Decreasing	CR ²⁹	Regionally threatened subspecies
Brown bear	<i>Ursus arctos</i>	LC	Stable	VU	Regional populations may be declining
Golden eagle	<i>Aquila chrysaetos</i>	LC	Stable	VU	Sensitive large raptor
Bearded vulture	<i>Gypaetus barbatus</i>	NT	Decreasing	EN	Confirmed from Tajik Red Book
Saker falcon	<i>Falco cherrug</i>	EN	Decreasing	EN	High conservation concern
Himalayan griffon	<i>Gyps himalayensis</i>	NT	Decreasing	VU	Confirmed from Tajik Red Book

²⁹ The national Red List in the table of species places this species as VU but in the species description uses CR. As a precautionary approach the higher categorisation has been used in this assessment

Species (Common Name)	Scientific Name	IUCN Status	Population Trend	Tajik Red Book Status	Notes
Ibisbill	Ibidorhyncha struthersii	LC	Stable	EN	Riverine habitat specialist
Siberian ibex	Capra sibirica	LC	Stable	Not listed	Key prey species
Wild boar	Sus scrofa	LC	Increasing	Not listed	Widespread species
Stone marten	Martes foina	LC	Stable	Not listed	Widespread species
Eurasian badger	Meles meles	LC	Stable	Not listed	Widespread species
Eurasian otter	Lutra lutra	NT	Increasing	EN	Sensitive to water quality

Source: IUCN Red List (v2025-2); Red Data Book of the Republic of Tajikistan (2024); Critical Habitat Assessment, Rev01, April 2026.

Nurek Reserve

A state zakaznik named Нурекский (Nureksky) is listed among the thirteen state zakazniki of Tajikistan and is recorded in the World Database on Protected Areas (WDPA ID: 555571313), with a reported area of 300 km² (Protected Planet, 2026). Zakazniki constitute the third tier of Tajikistan's eight-tier protected area system and carry a regulated-use regime intended to protect specific natural complexes, habitats, or species. The Nureksky zakaznik's stated conservation objectives include the protection of pistachio woodlands, broadleaved forests, and associated fauna including snow leopard, common lynx, Siberian ibex, urial, stone marten, and Eurasian otter. Unlike a strict nature reserve (zapovednik) or national park, a zakaznik is a partial protection zone — it doesn't exclude all human activity, but restricts specific uses to protect particular species, habitats, or ecological functions.

As confirmed by Figure 35, the Nureksky zakaznik is located on the western side of the Vakhsh Range, in an entirely separate catchment from the BSK corridor. Although the straight-line distance between the Project alignment and the zakaznik boundary is relatively short, the two are separated by a continuous mountain ridgeline with a height differential of over 600 m above the road corridor. There is no road connection, track, or accessible route between the BSK alignment and the zakaznik across this ridge. The Project road therefore does not and will not provide meaningful access to the zakaznik — the physical barrier of the intervening ridge effectively precludes any Project-induced increase in human access to the site. For this reason, the operational-phase risk of increased access, poaching, or encroachment that would typically be associated with road improvement projects in proximity to protected areas is considered negligible in relation to the Nureksky zakaznik, notwithstanding its geographic proximity as the crow flies.

Figure 35: Nurek Reserve



Source: IBAT, 2026

Bukhara Deer Nursery

A letter from CEP letter of December 2024 (see Annex E) draws attention to an important additional feature directly adjacent to the road corridor: a 3-hectare Bukhara Deer (*Cervus hanglu bactrianus*) breeding facility located at Dashtaro village, near km 35 of the alignment. This facility operates under the superintendence of Sari Khosor Natural Park and accordingly carries legal protected status as a remote object of the Park system.

Cervus hanglu bactrianus (Bukhara Deer) is listed as Critically Endangered (CR) on the IUCN Red List. The CEP letter explicitly requests that potential construction and operational impacts on the facility be taken into account during project planning. The facility is a confirmed, spatially defined receptor for a CR species and is treated as a Priority Biodiversity Feature under the CHA.

Other Protected Areas and International Designations

No additional nationally designated protected areas in proximity to the Project corridor have been identified through available sources.

A search of the Integrated Biodiversity Assessment Tool (IBAT) identified no Key Biodiversity Areas (KBAs) within 1 km or 10 km of the project. One KBA — the Dangara Massif KBA, designated on species-based criteria for threatened species — is located within the 50 km IBAT search buffer. It is relevant for wide-ranging species connectivity assessment (Snow Leopard, raptors, large ungulates) but does not represent a spatially proximate constraint on the Project. The IBAT search also identified two further designated protected areas within the 50 km buffer: Romit State Reserve (IUCN Category Ia — Strict Nature Reserve) and Childukhtaronsky State Reserve (IUCN Category IV). Both are located well beyond the project corridor and outside the defined EAAA. No direct or indirect project impacts on either reserve are anticipated, and neither has been considered further in this assessment.

6.2.3. Flora and Fauna

Survey Basis and Data Sources

The baseline flora and fauna assessment for the BSK Project draws on a combination of desk-based study and field surveys undertaken in 2025 and 2026. The primary data sources are:

- Latifi, A. (2026) — desk-based biodiversity assessment: A comprehensive literature-based inventory of flora and fauna for the Sari Khosor area, prepared in January–February 2026. Covers vegetation communities, plant species lists (including 147 endemics and 20 Red Data Book plant species), and fauna assemblages based on published records, existing biodiversity databases, and expert consultations with specialists from the Institute of Zoology and Parasitology and the Institute of Botany of the Academy of Sciences of the Republic of Tajikistan.
- Shamsiddinov, F.A. (2025) — aquatic biology field survey: A dedicated field survey of the ichthyofauna, benthos community, and water quality of the Shurobdaryo, conducted in 2025 at four sampling points distributed along the road corridor (km 54, km 35, km 20, and km 1). Physical fish sampling, substrate sampling, invertebrate netting, and basic water quality measurement (temperature, Secchi disc transparency, dissolved oxygen) were undertaken.
- Latifi, A. (2026) — field survey, 23–24 March 2026: Walkover botanical and faunal transect surveys along the corridor, covering flora, birds, reptiles, amphibians, and mammals. Survey conditions were hampered by poor weather. Results are preliminary: March represents an early point in the vegetation and wildlife activity season in this montane setting, and many plant and reptile species had not entered their active phase.
- Latifi, A. (2026) — Red Book species lists: Specialist lists of Red Data Book animal species (12 March 2026) and plant species (10 March 2026) potentially occurring within the project area, prepared following consultation with taxonomic specialists.
- Muhammadsoleh (Oev), M. (2026) — botanical corridor survey, 8–10 May 2026: Transect survey along the full road corridor (27 survey sites, each a 100 m transect with a 10 m buffer either side), targeting Red Data Book trees, rare *Allium* and wild tulips. Provided the first field confirmation of rare wild pear and wild apple individuals within the corridor, with GPS coordinates, habitat descriptions and tree-condition data.
- Khanjarov, A. and Ergashev, S.T. (2026) — geobotanical and carnivore mission, 9–10 May 2026: Route-based botanical and faunal survey of the corridor section, characterising the woody flora (25 species, five protected) and the Red Data Book herbaceous flora of the area, and undertaking carnivore-focused observations.
- Khursand, Nugzar and Talbonov, Kh.M. (2026) — bird and Eurasian Otter survey, 8–10 May 2026, with Stage 2 repeat (Garibmamadov, Talbonov et al., IZP NAST), 16–18 May 2026: Route-and-point bird counts at 14 observation points over the 54 km corridor (two-hour watches per point), with a parallel bankside otter sign survey along the Shurobdaryo and Local Ecological Knowledge (LEK) interviews. The Stage 2 repeat re-confirmed nest occupancy.
- Ergashev, S.T. (2026) — raptor monitoring and community consultation, 9–10 May 2026: Structured raptor observations from 14 vantage points over the 56 km route, with six structured questionnaire interviews with corridor residents between Bogi Zogon and Doshmandi villages.

The targeted field survey programme planned for the active season has now been substantially delivered through a May 2026 mobilisation, comprising the four work packages listed above (botanical, geobotanical/carnivore, bird and otter, and raptor/consultation surveys). The results are incorporated into the taxon sections below and materially upgrade the corridor presence status of several Priority Biodiversity Features. A short follow-up bird mobilisation (Stage 3) remains



programmed to confirm presence or absence of the cliff-nesting raptor PBFs not yet field-confirmed, and a targeted pre-construction otter holt survey at the Shoidon bridge remains outstanding. The baseline presented in this section reflects evidence available as of the May 2026 mobilisation.

Throughout this section, confidence in the presence of each species within the project corridor is assessed on the following basis:

- **Confirmed** — field-confirmed in the project corridor or within its immediate vicinity during project surveys.
- **Likely** — not yet field-confirmed in the corridor, but presence is supported by appropriate habitat, literature records from the wider area, and/or expert assessment.
- **Possible** — recorded in the broader EAAA or adjacent ranges in the literature, but habitat suitability within the corridor is partial or uncertain.
- **Unlikely** — elevation, habitat type, or established range makes occurrence in the road corridor unlikely, though the species may be present in the wider landscape.

Flora

Vegetation Communities - The flora of the Sari Khosor area is exceptionally diverse, reflecting the complex terrain, geology, and altitudinal variation of the South-Western Natural Province of Tajikistan. The regional flora includes more than 1,500 species of flowering plants and 107 species and subspecies of algae, with a high level of endemism (147 endemic species recorded by Latifi, 2026). Twelve of the twenty vegetation types recognised in Tajikistan's national classification system occur within the Sari Khosor area. Vegetation communities present in the wider area are summarised in Section 6.2.1.

Within the project corridor itself, the vegetation is largely representative of disturbed and modified communities. The existing road formation, adjacent embankments, bare and eroding slopes, and active floodplain create conditions that strongly favour ruderal and disturbance-tolerant species. The most ecologically intact vegetation occurs in the narrow riparian strip along the Shurobdaryo — comprising fragmented poplar (*Populus* spp.), willow (*Salix* spp.) and sea buckthorn (*Hippophae rhamnoides*) growth — and on undisturbed rocky slopes away from the existing road formation where sparse shrubland and herbaceous communities persist.

Figure 36: Tributary gorge with early-spring riparian scrub (willow, poplar, shrub layer) within the project corridor, March 2026. These tributary confluences represent the most structurally intact natural vegetation along the alignment.



Source: ESIA Team

Biodiversity Survey Methodology

The biodiversity baseline for the BSK Project was built from a phased programme of desk-based review and field survey, designed to satisfy the data requirements of EBRD ESR6 and to support the Critical Habitat Assessment. The programme proceeded from a broad literature-based characterisation of the wider Sari Khosor area to targeted, season-appropriate field surveys of the road corridor itself, culminating in the May 2026 mobilisation that confirmed the corridor's key Priority Biodiversity Features and Critical Habitat-triggering species.

Desk study and Red Data Book screening - The desk phase (Latifi, January–February 2026) compiled a literature-based inventory of flora and fauna for the Sari Khosor area, drawing on published records, biodiversity databases, and consultation with taxonomic specialists at the Institute of Zoology and Parasitology and the Institute of Botany of the Academy of Sciences of the Republic of Tajikistan. It established the regional species pool — including 147 endemic plants and 20 Red Data Book plant species — and produced specialist Red Data Book lists for plants (10 March 2026) and animals (12 March 2026) screened for potential occurrence in the project area. This screening, cross-referenced against the IUCN Red List and the Integrated Biodiversity Assessment Tool (IBAT), generated the long list of candidate species carried forward into the Critical Habitat and PBF assessment.

Aquatic survey (2023) - A dedicated aquatic biology field survey (Shamsiddinov, 2023) characterised the ichthyofauna, benthic invertebrate community, and water quality of the Shurobdaryo at four sampling points distributed along the corridor (km 54, km 35, km 20, and km 1). Methods comprised physical fish sampling, substrate and invertebrate sampling, and in-situ water quality measurement (temperature, Secchi-disc transparency, and dissolved oxygen). This survey confirmed the presence and autumn upstream spawning migration of Amu Darya trout (*Salmo trutta oxianus*), the basis for its designation as a migratory-pathway PBF.

Early-season walkover (March 2026) - An initial botanical and faunal walkover (Latifi, 23–24 March 2026) ran transect surveys along the corridor covering flora, birds, reptiles, amphibians, and mammals. The survey was constrained by early-season conditions and poor weather: many

herbaceous species had not emerged, geophytes such as tulips and eremurus were not yet in active growth, and reptiles were largely inactive. Its results were treated as preliminary and were subsequently superseded, for the Red Book tree and geophyte species, by the targeted May survey conducted within the active phenological window.

Targeted botanical survey (May 2026) - The definitive botanical survey (Muhammadsoleh, with geobotanist Khanjarov and carnivore specialist Irgashev, 8–10 May 2026) was timed for the active flowering and foliage period to maximise detection of tree-form Red Book taxa. Method:

- Transect survey along the full Baljuvon–Sari Khosor alignment with a 10 m buffer on each side, supplemented by pause-and-meander searches at suitable habitat units (dry rocky slopes, foothill vegetation, river valleys, shrublands, and tugai fragments).
- Target species: Red Data Book tree species — particularly *Pyrus tadshikistanica*, *P. korshinskyi*, and *Malus sieversii* — together with rare *Allium* species and wild tulips (*Tulipa* spp.).
- For each confirmed individual of a rare tree species, the team recorded GPS coordinates and elevation (handheld GPS), number of individuals, approximate age class, estimated height, distance from the road, and reproductive status (presence/absence of flowers and fruit).
- Habitat condition was assessed at each record — slope exposure, terrain, moisture, associated vegetation, and visible disturbance (grazing, wood-cutting, road impacts, erosion) — and whether the species occurred as isolated individuals or local populations.
- Tugai fragments along river and seasonal-watercourse sections were mapped and described through rapid vegetation assessment, providing field input to the CHA Criterion 4 (tugai ecosystem) check.
- Identification followed the *Flora of Tajikistan* with cross-reference to the Red Data Book of the Republic of Tajikistan (2024). All records were photographed and logged in field notebooks and GPS devices, then compiled into a database for mapping and species lists.

Bird and Eurasian Otter survey (8–10 May 2026) - A parallel ornithological and mammal survey (Khursand, Nugzar, Talbonov and Ergashev, 8–10 May 2026) covered the corridor's scavenging raptors and riverine mammals. Method:

- Structured observation watches of two hours at 14 fixed observation points across the route (elevation range 946–1,422 m a.s.l.), targeting cliff-nesting and scavenging raptors — Egyptian Vulture, Cinereous Vulture, Bearded Vulture, Golden Eagle, Barbary Falcon — and riverine specialists, with active searching for vulture nest sites. For each nest, location was fixed by GPS and bearing/distance to the observation point.
- Bankside sign survey for Eurasian Otter along the Shurobdaryo, recording the standard field signs — tracks, spraints, slides, prints, and feeding remains.
- Local ecological knowledge (LEK) interviews: six structured questionnaire interviews with residents between Bogi Zogon and Doshmandi villages, using photograph and brief-description recall aids, with a respondent profile spanning a forestry game warden, a teacher, village residents, and herders from Vakhsh and Yavan districts.
- Survey work on 10 May was curtailed in the upper river by heavy rainfall and a rapid rise in water levels.

Red Book Plant Species

Twenty Red Data Book plant species have been recorded in the Sari Khosor area based on desk study and literature review (Latifi, 2026). Seventeen species with confirmed or potential occurrence in the project area are listed in the table below, based on the Red Data Book plant species assessment prepared for the project (Latifi, March 2026).

The May 2026 botanical survey field-confirmed three of these species within the corridor for the first time: *Pyrus tadshikistanica* and *Pyrus korshinskyi* (both upgraded from Possible to Confirmed), and *Malus sieversii* (upgraded to Confirmed), together with a population of Anzur onion (*Allium* sp.). The corridor-presence column in Table 33 should be updated accordingly. The remaining listed species were not confirmed in the surveyed sections but cannot be excluded elsewhere along the alignment; targeted pre-construction botanical survey of the engineered footprint remains required. Both CR wild pear species are now confirmed Priority Biodiversity Features under the CHA.

Two species — *Tulipa praestans* and *Tulipa anisophylla* (both IUCN VU) — are confirmed as Priority Biodiversity Features under the CHA on a precautionary basis, given their restricted range within the project area's broader landscape context.

Figure 37: (left): Close-up of *Eremurus* sp. or *Juno/Iris* sp. rosette on dry clay slope within the project corridor, March 2026. (right): Population of the same species on a hillside slope adjacent to the road edge



Source: ESIA Team field survey, March 2026.

Table 33: Red Data Book Plant Species with Confirmed or Potential Occurrence in the Project Area

Species	Status	Listing	Corridor Presence	Notes
<i>Tulipa praestans</i> Hoog	VU	IUCN + Tajik RDB	Likely	Confirmed PBF (CHA Appendix X). Targeted pre-construction survey required.
<i>Tulipa anisophylla</i>	VU	Tajik RDB	Likely	Confirmed PBF (CHA). Targeted pre-construction survey required.
<i>Ostrowskia magnifica</i> Regel	VU	Tajik RDB	Likely	Tertiary relict species. Mid-mountain rocky slopes. Pre-construction survey required.
<i>Fritillaria eduardii</i> Regel (syn. <i>Petilium eduardii</i>)	VU	Tajik RDB	Likely	Tertiary relict. Scattered distribution in Central and Southern Pamir–Alai.

Species	Status	Listing	Corridor Presence	Notes
<i>Pyrus korshinskyi</i> Litv.	CR	IUCN + Tajik RDB	Confirmed	Rocky and scrub slopes of Vakhsh and Hazrati Shoh ranges.
<i>Pyrus tadshikistanica</i> Zapr.	CR	IUCN + Tajik RDB	Confirmed	Rare endemic; Vakhsh, Hazrati Shoh and Darvaz ranges.
<i>Malus sieversii</i> (Ledeb.) M. Roem.	EN	Tajik RDB + CITES	Confirmed	Present in broadleaf forest communities of the wider area. Wild apple.
<i>Amygdalus vavilovii</i> M. Pop.	EN	Tajik RDB	Possible	Yakhob and Obisurkh river basins; Hazrati Shoh range.
<i>Iris darwasica</i> Regel	VU	Tajik RDB	Possible	Rocky mid-mountain slopes of Hissar–Darvaz region.
<i>Iris hoogiana</i> Dykes	VU	Tajik RDB	Possible	Hissar, Karategin, Vakhsh and Darvaz ranges.
<i>Juno nicolai</i> Vved.	VU	Tajik RDB	Possible	Hissar, Vakhsh and Hazrati Shoh ranges.
<i>Allium rosenbachianum</i> Regel	VU	Tajik RDB	Possible	Vakhsh, Hazrati Shoh and Darvaz ranges.
<i>Allium stipitatum</i> Regel	VU	Tajik RDB	Possible	Widespread in Tajikistan including Southern Tajikistan.
<i>Crocus korolkowii</i> Regel & Maw	VU	Tajik RDB	Possible	Foothills and low mountains of Southern Tajikistan.
<i>Ferula tadschikorum</i> M. Pimen.	EN	Tajik RDB	Possible	Rare endemic ferula; further survey required.
<i>Anemone bucharica</i> Regel	VU	Tajik RDB	Possible	Southern Tajikistan including Hazrati Shoh range spurs.
<i>Bunium persicum</i> (Boiss.) B. Fedtsch.	VU	Tajik RDB	Possible	Widespread across Tajikistan; potential occurrence throughout corridor.

Source: Latifi (2026); Red Data Book of the Republic of Tajikistan (2024); IUCN Red List (v2025-2).

Additional common species characteristic of the project corridor's disturbed and semi-natural habitats include elements of the shiblyak scrub formation (pistachio *Pistacia vera*, almond *Amygdalus bucharica*, hackberry *Celtis caucasica*, hawthorn *Crataegus* spp.), herbaceous steppe communities, and riparian growth (poplar, willow, sea buckthorn). The broader area supports 147 endemic plant species; while most are unlikely to be concentrated within the disturbed road corridor itself, the

adjacent undisturbed slopes and rocky habitats may harbour endemic and range-restricted plants, particularly in the upper sections of the alignment approaching km 50–56.

Figure 38: Mature *Pyrus tadshikistanica* (Critically Endangered) at km 29, growing at the edge of the existing alignment.



Source: ESIA Team, 2026

Figure 39: Veteran ("old tree") *Pyrus tadshikistanica* (CR) at Chilton, km 34 (left side of track), growing against the rock outcrop where the existing track passes immediately beside its canopy and root zone.



Source: ESIA Team, 2026

Fauna

Fish and Aquatic Ecology - The aquatic biology of the Shurobdaryo was assessed through a dedicated field survey conducted by Shamsiddinov (2023), with sampling at four points spanning the length of the project corridor. This is the primary field-based source for ichthyofauna and water quality data.

Table 34: Sampling locations and water quality conditions

Sampling Point	Location	Water Temp. (°C)	Secchi Transparency (cm)	Key Observations
Point 1	Sari Khosor Natural Park area, km 54	Cool (not recorded)	65	Clear, good aquatic vegetation and macroinvertebrates; trout and marinka dominant
Point 2	Sadoho village, km 35	12	52	Trout, marinka, bullhead, catfish, silver carp; carp and snakehead reported by local fishers

Sampling Point	Location	Water Temp. (°C)	Secchi Transparency (cm)	Key Observations
Point 3	Doshmandi village, km 20	14	48	Good macroinvertebrates; trout, marinka, carp present; conditions slightly warmer
Point 4	Sari Mazar bridge, km 1	21	39	Warmest point; lowest clarity; podus (<i>Chondrostoma</i> sp.) recorded

Source: Shamsiddinov (2023). Note: Point 1 at km 54 is adjacent to Sari Khosor Natural Park boundary.

Table 35: Shurobdaryo in spring flood condition showing the wide, braided, unvegetated gravel bar system — Priority Biodiversity Feature habitat types C3.62 (Unvegetated River Gravel Banks) and C3.55 (Sparsely Vegetated River Gravel Banks). Lower



Source: ESIA Team (field photograph, 01/04/2026).

The temperature and clarity data show a clear downstream gradient, with the upper reaches (km 54) being cooler and clearer than the lower reaches (km 1). This pattern is consistent with the altitudinal gradient along the corridor (approximately 920 m at the southern end to 1,625 m at the northern end) and reflects the salmonid-typical habitat conditions present in the upper corridor — cold, well-oxygenated, clear water with clean gravel substrate.

Fish species recorded - Shamsiddinov (2023) confirmed the following fish species along the project corridor through direct physical sampling:

Table 36: Fish Species Recorded

Species	Local / Russian name	Mean length (cm)	Mean weight (g)	Confidence	Notes
<i>Salmo trutta oxianus</i> — Amu Darya (IUCN LC)	Форель ручьевая / Гулмоҳӣ	31	72	Confirmed	Sampled at km 54 and km 35; 20 specimens. Autumn upstream spawning migration confirmed. VU nationally; confirmed PBF (CHA). Dominant species in upper reaches.
<i>Schizothorax intermedius</i> — Common marinka (IUCN LC)	Маринка / Ширмоҳӣ	19	51	Confirmed	Confirmed at km 54; 20 specimens. Second most abundant species at upper sampling points.
<i>Glyptosternum reticulatum</i> — Turkestan mountain catfish (IUCN LC)	Сом / Лаққамоҳӣ	11	32	Confirmed	19 specimens at km 35. VU nationally. Mountain catfish family (Sisoridae); sole Central Asian representative. Benthic specialist sensitive to sedimentation.
<i>Gobio</i> sp. — Bullhead (ND)	Бычок / Сағмоҳии аралӣ	12	36	Confirmed	13 specimens at km 35.
Silver carp (ND)	Карась серебряный / Переси нуқрагун	17–18	50–55	Confirmed	18–19 specimens at km 35; also confirmed at km 20.
<i>Chondrostoma</i> sp. — Podus/Podust (ND)	Подус	24	53	Confirmed	120 specimens recorded at km 1 (lowest sampling point); warm-water adapted cyprinid of the carp family.
<i>Barbus capito conocephalus</i> — Turkestan barbel (VU IUCN)	—	—	—	Possible	Recorded in wider Sari Khosor area by Latifi (2026). Not detected by Shamsiddinov (2025) at any of the four sampling points. VU nationally. Precautionary PBF under CHA.
Carp, snakehead — species reported by local fishers	Сазан, Змееголов	—	—	Possible	Reported by local fishers at km 35 during early summer; not physically sampled. Warm-water

Species	Local / Russian name	Mean length (cm)	Mean weight (g)	Confidence	Notes
					species; more likely in lower reaches.
<i>Pseudoscaphirhynchus hermanni</i> / <i>P. kaufmanni</i> — shovelnose sturgeons (IUCN CR)	—	—	—	Unlikely	Not recorded in the Shurobdaryo system; absent from field survey. No records from this river; <i>P. hermanni</i> not recorded in Tajikistan since 1997; <i>P. kaufmanni</i> last recorded 2012.

Source: Shamsiddinov (2025); Latifi (2026); Artaev et al. (2025).

The Shamsiddinov (2023) survey records 12 species of benthic invertebrates (benthos) from the Shurobdaryo system, representing the primary food source for salmonid fish. Benthos taxa confirmed include representatives of Chironomidae (non-biting midges), Oligochaeta (aquatic worms), Odonata (dragonfly larvae), and Amphipoda (*Carinoqammans zoescheli*). Additional invertebrate taxa recorded include *Nais elinguis*, *Cricotopus alex*, *Pristina bilobeta*, and *Zemnodrilis hottmeisteri*. Ten phytoplankton types and two rotifer taxa were also recorded. This diverse and productive benthic community confirms the good ecological condition of the upper river reaches and underpins the habitat value for both fish and otter.

Dissolved oxygen levels recorded in the Shurobdaryo range from 6.10 mg/l in September to 10.7 mg/l at other times of year (Akhrorov, 1999), consistent with good water quality supporting salmonid populations. The well-oxygenated, clear, cool conditions at the upper sampling points (km 54 and km 35) represent high-quality cold-water fish habitat.

Amu Darya Trout, spawning migration: Shamsiddinov (2023) explicitly confirms that adult fish — including Amu Darya Trout, — migrate upstream in autumn to spawn in the upper reaches of the Shurobdaryo. This is a field-confirmed, regular, cyclical biological event occurring within the project river corridor.

Invertebrates - The Sari Khosor area supports approximately 2,000 insect species, with representatives of nearly all 30 insect orders known from Tajikistan (Latifi, 2026). The majority of these are common and widespread; however, a number of Red Data Book species are recorded in the literature from the broader Sari Khosor area. The following species are considered relevant to the project based on their range and habitat associations:

Table 37: Invertebrates

Species	Status	Order	Corridor Presence	Notes
<i>Dorcus sewertzowi</i> — Sewertzov's stag beetle	EN	Coleoptera	Possible	Sole lucanid beetle in Central Asia. Restricted to Vakhsh, Darvaz and Hazrati-Shoh ranges. Forest-dependent; requires mature broadleaf trees. Unlikely within the disturbed road corridor; possible in intact broadleaf forest patches on adjacent slopes.

Species	Status	Order	Corridor Presence	Notes
<i>Mallosia regina</i> — Regina longhorn beetle	VU	Coleoptera	Possible	Endemic to Tajikistan; Hissar–Darvaz region. Habitat and host plant associations require clarification through further survey.
<i>Geotrupes banghaasi</i> — Dung beetle	VU	Coleoptera	Possible	Endemic to Tajikistan; Hissar–Darvaz area including Vakhsh range. Associated with large mammal dung; presence linked to ungulate populations.
<i>Acosmeryx naga hissarica</i> — Hissar hawk moth	EN	Lepidoptera	Possible	Endemic subspecies restricted to Hissar–Vakhsh foothills at 1,000–1,600 m. Taxonomic validity disputed by some authorities. Habitat (riparian scrub and aquatic vegetation) present in corridor but survey coverage insufficient to confirm absence.
<i>Polyommatus avinovi</i> (syn. <i>Afarsia avinovi</i>) — Avinov’s blue butterfly	EN	Lepidoptera	Unlikely	Endemic butterfly; national Red Data Book EN. Distribution centred on Peter the Great Mountain (Khazor Chashma area), Khazrati Shoh ridges, and the Dangara massif — outside the project area of influence. CHA impact assessment concludes no significant effect; confirmed PBF on national Red List basis.
<i>Empusa pennicornis</i> — Cone-headed mantid	EN	Mantodea	Possible	South-western Tajikistan and Sughd; up to 1,800 m. Open grassland and scrub habitats present in corridor.
<i>Anax imperator</i> — Emperor dragonfly	VU (national)	Odonata	Possible	Mountain and foothill areas up to 2,200 m. Presence linked to standing or slow water; main channel too fast-flowing, but backwaters and tributary confluences may be suitable.
<i>Coenagrion scitulum</i> — Dainty damselfly	VU (national)	Odonata	Possible	Recorded in the Sari Khosor area by Latifi (2026). Requires standing or slow-moving water; main channel too fast-flowing but backwaters, tributary confluences, and irrigation features may provide suitable habitat.
<i>Libelloides macaronius</i> — Owlfly	VU (national)	Neuroptera	Possible	Recorded in the Sari Khosor area by Latifi (2026). Associated with dry, open grassland and scrub on warm

Species	Status	Order	Corridor Presence	Notes
				slopes — habitat types present throughout the corridor.
<i>Papilio machaon</i> — Swallowtail butterfly	VU (national)	Lepidoptera	Possible	Recorded in the Sari Khosor area by Latifi (2026). Widespread species associated with open flowery habitats and umbelliferous host plants; expected in grassland and scrub sections of the corridor.
<i>Driopa mnemosyne</i> — Clouded Apollo	VU (national)	Lepidoptera	Possible	Recorded in the Sari Khosor area by Latifi (2026). Associated with rocky slopes and meadows with <i>Corydalis</i> host plants; possible in upper sections of the corridor approaching km 50–56.

Source: Latifi (2026 fauna report); Red Data Book of the Republic of Tajikistan (2024).

Amphibians - Amphibian diversity in the project corridor is limited by the arid, steeply-graded character of much of the terrain. The March 2026 field survey confirmed one amphibian species:

- Green toad (*Bufo viridis*) — **Confirmed**: Individuals observed near water bodies and moist habitats during the March 2026 survey. The species demonstrates high ecological plasticity and is present throughout the corridor wherever standing or slow-moving water exists. Not a Red Data Book species. Plays an important ecological role as an invertebrate predator and indicator of humid habitat condition.
- Marsh frog (*Pelophylax ridibundus*) is recorded from the Sari Khosor area in the literature (Latifi, 2026) and is **Likely** to be present in suitable riparian microhabitats, particularly at lower elevations. No additional amphibian species are expected in the road corridor given prevailing habitat conditions.

Reptiles - Latifi (2026) records 24 reptile species from the Sari Khosor area. The March 2026 field survey confirmed two species within or near the project corridor:

- Lehmann's agama (*Laudakia lehmanni*) — **Confirmed**: Individuals observed on open, sun-exposed rocky substrates. A widespread species of arid and rocky mountain habitat; expected throughout the rocky sections of the corridor.
- Pannonian snake-eyed skink (*Ablepharus pannonicus*) — **Confirmed**: Recorded in areas with sparse vegetation and loose, warm soil. Common across the region; expected throughout the disturbed and rocky sections of the corridor.

The following nationally Red-listed reptile species are relevant to the project based on their range and habitat associations:

Table 38: Reptiles

Species	Status	Corridor Presence	Notes
<i>Pseudopus apodus</i> — European glass lizard ³⁰	EN (national)	Likely	Confirmed in wider Sari Khosor area by Latifi (2026). Absent from March 2026 field survey, but March is early in the reptile activity season and

³⁰ Note: the CHA records uncertainty as to whether this species is included in the 2024 national Red Data Book update; its PBF status is retained on a precautionary basis pending confirmation.

Species	Status	Corridor Presence	Notes
			absence is not considered indicative. Rocky slopes, sparse woodland edges and scrub — all present in corridor. Fossorial and slow-moving; high vulnerability to mechanical clearance. Confirmed PBF under CHA. Pre-construction reptile survey required April–September. Incidental adult recorded May 2026 at 38.35418 / 69.69446.
<i>Novoeumeces schneiderii</i> — Schneider's skink	EN (national)	Possible	Range covers south-western Tajikistan foothills including lower Surkhob valley. Rocky, sun-warmed slopes. Active season survey required to assess corridor presence.
<i>Xerotyphlops vermicularis</i> — Worm snake	EN (national)	Possible	Foothills and river valleys of Vakhsh and Surkhob systems. Fossorial; associated with loose loess and clay soils on lower slopes.
<i>Eryx tataricus</i> — Tatar sand boa	EN (national)	Possible	Sandy loess foothills and valley floors of Surkhob catchment. Possible in lower sections of corridor (km 0–10).
<i>Testudo horsfieldii</i> — Central Asian tortoise	VU (IUCN + national); CITES II	Possible	Three distribution areas in Tajikistan including Surkhob valley foothills. Open loess slopes and grassland. Possible at lower elevations; active season survey required.
<i>Macrovipera lebetina turanica</i> — Central Asian Levant viper	VU (national)	Likely	Rocky slopes and scrub throughout south-western Tajikistan. Listed by Latifi (2026) among the most common reptiles in the wider Sari Khosor area. Expected in rocky habitat types throughout the corridor.

Source: Latifi (2026 fauna report and field survey); Red Data Book of the Republic of Tajikistan (2024).

Common reptile species recorded in the wider Sari Khosor area by Latifi (2026) and expected throughout the corridor include spotted whip snake (*Hemorrhois ravergieri*), dice snake (*Natrix tessellata*), Turkestan agama (*Paralaudakia lehmanni*), and Tajik racerunner (*Eremias regeli*). All are common and widespread species of rocky and semi-arid habitat.

One further species assessed in the CHA — the Tajikistan even-fingered gecko (*Alsophylax tadjikiensis*, CR IUCN) — was considered and dismissed. Although the IUCN range boundary approaches the south of the project area, the species' maximum recorded elevation is 500 m, well below the project corridor (920–1,625 m asl). Presence in the corridor is considered negligible.

Birds - The avifauna of the Sari Khosor area is rich, with 84 species recorded in the wider area (Latifi, 2026), comprising 9 resident species, 12 migratory species, 60 passage and breeding species, and 3 vagrant species. The March 2026 field survey recorded 11 bird species within or directly adjacent to the project corridor:

- Griffon vulture (*Gyps fulvus*) — **Confirmed** : 7 individuals observed in one group, likely attending carrion.
- Egyptian vulture (*Neophron percnopterus*) — **Confirmed** : 2 individuals in the same group. EN nationally, PBF under CHA. Breeding species of Tajikistan.

- Cinereous vulture (*Aegypius monachus*) — Confirmed : 2 individuals. VU nationally.
- Black kite (*Milvus migrans*) — Confirmed : 12 individuals. Common; observed attending the same carrion site.
- White-throated dipper (*Cinclus cinclus*) — Confirmed : 2 individuals near watercourses. Characteristic riparian specialist; indicative of good river ecological condition.
- Blue whistling thrush (*Myophonus caeruleus*) — Confirmed : 1 individual. VU nationally; associated with mountain gorges and riverine habitat.
- Common myna (*Acridotheres tristis*), common blackbird (*Turdus merula*), eastern rock nuthatch (*Sitta tephronota*), common chaffinch, Eurasian magpie, and carrion crow — all Confirmed during March 2026 survey. Common and widespread species.

Figure 40: Vulture group observed during March 2026 field survey within the project corridor. The observation of four raptor species at one location indicates the presence of stable trophic interactions within the valley ecosystem.



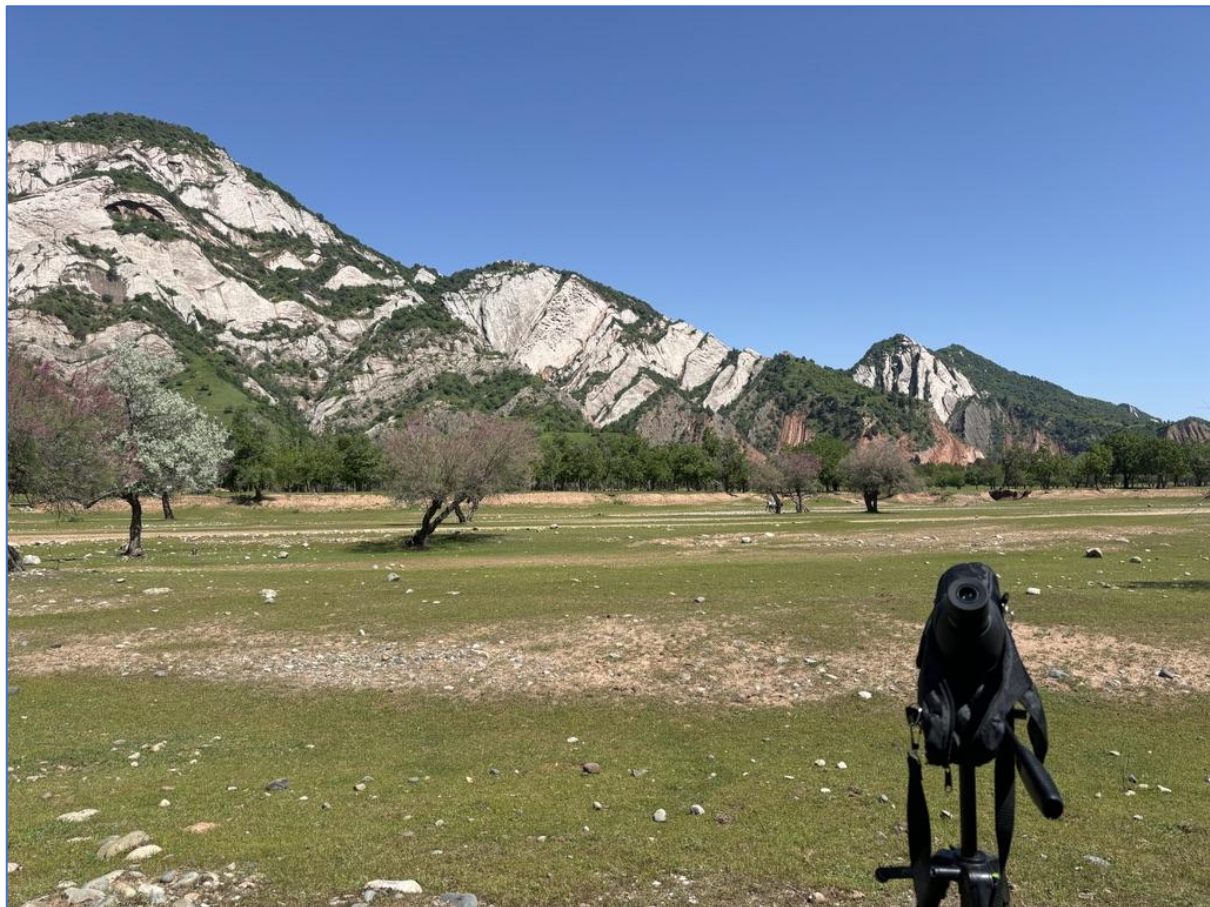
Source: ESIA Team, 2026

The targeted breeding-bird and raptor surveys planned for the active season were delivered in May 2026 (Khursand, Nugzar and Talbonov, 8–10 May, with a Stage 2 repeat 16–18 May; and Ergashev, 9–

10 May). These surveys substantially advance the raptor baseline and move the Egyptian Vulture from a confirmed foraging presence to a confirmed corridor breeder at multiple locations. Six Egyptian Vulture nests were confirmed along the corridor — three at the cliff face near 38.54289 N / 69.87254 E, two near 38.55266 N / 69.88575 E, and one near 38.33192 N / 69.68716 E at approximately km 2, within the works zone — all re-confirmed as occupied during the Stage 2 repeat. A separate raptor expedition independently confirmed an Egyptian Vulture nest and, for the first time, a Cinereous Vulture nest at km 2–4 within the planned works footprint; the Egyptian Vulture record corresponds to the same km 2 nest, while the Cinereous Vulture nest is an additional receptor. Cinereous Vulture is therefore upgraded to a confirmed corridor breeder. Supporting scavenger-guild counts comprised 12 Egyptian Vulture, 13 Griffon Vulture and 2 Cinereous Vulture individuals across the corridor, with a single Barbary Falcon (*Falco pelegrinoides*) recorded at a cliff-face vantage point in both survey stages and a Blue Whistling Thrush (*Myophonus caeruleus*) near km 14. Community consultations corroborated good local awareness of both vulture species.

Each confirmed active nest is a fixed receptor for the cliff-nesting raptor mitigation cascade, including a 250 m no-works exclusion buffer during the breeding season (1 March – 30 September) and a contractor pre-season nest survey before 1 March. A short Stage 3 mobilisation remains programmed to confirm presence or absence of the cliff-nesting raptor PBFs not yet field-confirmed (Saker Falcon, Bearded Vulture, Barbary Falcon nesting, Eastern Imperial Eagle) and the riparian specialists (Little Forktail, Yellow-eyed Pigeon).

Figure 41: Cliff-nesting raptor habitat in the upper corridor (vicinity of km 36) — limestone crags providing nesting sites for Egyptian and Cinereous Vulture.



Source: ESIA Team, 2026

Figure 42: Egyptian Vulture (*Neophron percnopterus*) at a cliff-cavity nest at km 2, within the works footprint — one of two confirmed active nests in the km 2–4 works zone.



Source: ESIA Team, 2026

Figure 43: Birds

Species	Status	Corridor Presence	Notes
<i>Neophron percnopterus</i> — Egyptian vulture	EN (national); EN (IUCN)	Confirmed	6 active nests confirmed May 2026, including one at km 2 in the works zone; all re-confirmed Stage 2
<i>Gypaetus barbatus</i> — Bearded vulture	EN (national); NT (IUCN)	Likely	Distributed across all mountain ranges of Tajikistan. Wide home range; project corridor within typical foraging range. Confirmed PBF

Species	Status	Corridor Presence	Notes
			under CHA. Pre-construction nest survey required.
<i>Aegypius monachus</i> — Cinereous vulture	VU (national); NT (IUCN)	Confirmed	Confirmed breeder — active nest at km 2–4 (works zone)
<i>Aquila heliaca</i> — Eastern imperial eagle	VU (IUCN)	Likely	Resident in Tajikistan; uses corridor as part of wide home range. Confirmed PBF under CHA. Pre-construction nest survey required.
<i>Aquila chrysaetos</i> — Golden eagle	VU (national); LC (IUCN)	Likely	Distributed across mountainous Tajikistan. Uses rocky cliffs for nesting and open slopes for foraging. Likely regular user of the wider valley.
<i>Falco cherrug</i> — Saker falcon	EN (national); EN (IUCN)	Likely	Breeding species in Tajikistan; uses open valley and cliff habitats. Confirmed PBF under CHA. Pre-construction nest survey required.
<i>Falco pelegrinoides</i> — Barbary falcon	EN (national); CITES I	Likely	Breeds on cliff faces in south-western Tajikistan. Rocky valley walls throughout the corridor are suitable nesting habitat. Confirmed PBF under CHA.
<i>Myophonus caeruleus</i> — Blue whistling thrush	VU (national); LC (IUCN)	Confirmed	1 individual field-confirmed March 2026. Associated with mountain gorges and riverine habitat; expected along the full riparian corridor.
<i>Ibidorhyncha struthersii</i> — Ibisbill	Listed (national); LC (IUCN)	Likely	Specialist of braided mountain rivers with gravel bars — exactly the habitat type present throughout the Shurobdaryo corridor. Not field-confirmed but high prior probability. Breeding surveys ongoing.
<i>Columba eversmanni</i> — Yellow-eyed pigeon	VU (IUCN)	Likely	IUCN area of occurrence overlaps corridor; uses mountain valleys with rivers. Confirmed PBF under CHA.
<i>Terpsiphone paradisi</i> — Asian paradise flycatcher	VU (national); LC (IUCN)	Possible	Recorded from Hissar, Darvaz and Karategin ranges. Riparian woodland and dense scrub; dependent on more mature vegetation than present in most of the corridor.
<i>Chaimarrornis leucocephalus</i> — White-capped redstart	VU (national); LC (IUCN)	Likely	Characteristic of fast-flowing mountain streams; expected along the Shurobdaryo corridor particularly in the upper reaches.
<i>Vanellus gregarius</i> — Sociable lapwing	CR (IUCN); PBF (Bern Conv.)	Unlikely	Passage migrant. Requires sandy plains, short grass and fallow land — habitat absent from project corridor. Not expected.

Source: Latifi (2026); March 2026 field survey; Red Data Book of the Republic of Tajikistan (2024); IUCN Red List (v2025-2).

Pallas's fish eagle (*Haliaeetus leucoryphus*, EN IUCN, Bern Convention Annex 1) was assessed in the CHA and dismissed. While the species is resident and possibly migratory within Tajikistan and habitat in the project area is broadly suitable, the global population (estimated 1,000–2,499 mature individuals) makes the 1% migratory/congregatory threshold approximately 10 individuals — a number the project area is unlikely to support. The species does not qualify as a PBF or trigger Critical Habitat.

Mammals - Latifi (2026) records 23 mammal species belonging to six orders from the Sari Khosor area. The March 2026 field survey recorded evidence of four mammal species through direct observation, track signs, and local interviews:

- Eastern mole vole (*Ellobius tancrei*) — **Confirmed** : Presence confirmed by characteristic soil mounds and burrows.
- Red fox (*Vulpes vulpes*) — **Confirmed** : 1 individual observed. Highly adaptable; expected throughout the corridor.
- Wild boar (*Sus scrofa*) — **Confirmed** : Regular occurrence confirmed by local residents; descends into valley habitats periodically.
- Turkestan rat (*Rattus turkestanicus*) — **Confirmed** : Recorded in areas of anthropogenic influence.

The May 2026 bank-sign survey along the Shurobdaryo provided the first field confirmation of Eurasian Otter (*Lutra lutra*) within the corridor. Otter signs were recorded at one location in the upper river near Shahidon village (38.52055 N / 69.82906 E, approximately 1,304 m a.s.l., near km 30), roughly 300 m downstream of an active bridge construction site, in a reach of deeper water and large rocky outcrops consistent with otter holting and foraging. Stone Marten (*Martes foina*) and Stoat (*Mustela erminea*) were sighted at the same location. Results were negative through the lower corridor, where the river broadens and shallows — a pattern consistent with the river-morphology argument in the CHA. Local fishermen near Shoidon independently corroborated otter presence (including otters taking fish from catches), while lower-corridor residents reported that otters are not seen there. An incidental record of European Glass Lizard (*Pseudopus apodus*, nationally Endangered) at 38.35418 N / 69.69446 E represents the first active-season corridor record for this species, supporting its assessment as Likely in Table 40.

The following nationally significant mammal species are assessed for the project area:

Figure 44: Mammals

Species	Status	Corridor Presence	Notes
<i>Lutra lutra</i> — Eurasian otter	EN (national); NT (IUCN); CITES I	Confirmed	Otter signs were recorded at one location in the upper river near Shahidon village Confirmed PBF under CHA. Pre-construction holt survey required before any bankside clearance commences.
<i>Ursus arctos isabellinus</i> — Tien Shan brown bear	EN (national); LC (IUCN); CITES I	Possible	Forest belt species. The corridor is within the subspecies range and bears may traverse the valley seasonally. The road works footprint is unlikely to directly affect core bear habitat. Confirmed PBF under CHA. Pre-construction survey and local consultations required.

Species	Status	Corridor Presence	Notes
<i>Lynx lynx isabellinus</i> — Eurasian lynx	EN (national); LC (IUCN)	Possible	Wide-ranging (home range 100–1,000 km ²). May use the corridor as part of a larger range but project impact on a small fraction of any individual's range is expected to be very low. Confirmed PBF under CHA.
<i>Panthera uncia</i> — Snow leopard	EN (national); VU (IUCN)	Unlikely	IUCN mapping places the species at or just north of the project area. Snow leopard habitat is generally above 3,000 m; the road corridor (920–1,625 m) is well below this. May cross the corridor during seasonal movements but is not a regular corridor species. Confirmed PBF under CHA (wider EAAA). Corridor itself considered unlikely regular habitat.
<i>Ovis vignei bochariensis</i> — Bukhara urial	CR (national); VU (IUCN)	Possible	Herd species; IUCN extent of occurrence overlaps project area. No field records from the corridor to date; desk study and local consultation have not confirmed presence. Confirmed PBF under CHA; additional field survey and community consultation ongoing.
<i>Vormela peregusna</i> — Marbled polecat	VU (IUCN)	Possible	Prefers steppe and open areas; the montane valley character of the corridor is not optimal, but not excluded. Confirmed PBF under CHA on precautionary basis.
<i>Dryomys nitedula</i> — Forest dormouse	VU (national); LC (IUCN)	Possible	Forest belt species; present in broadleaf and mixed forest communities of the wider area. Possible in intact scrub and woodland patches adjacent to the corridor.
<i>Hystrix indica</i> — Indian crested porcupine	VU (national)	Possible	Recorded in the Sari Khosor area by Latifi (2026). Associated with rocky slopes, scrub, and cultivated margins at lower and mid elevations. Nocturnal and fossorial; presence in the lower sections of the corridor (km 0–20) is plausible given suitable habitat and elevation. Not a PBF (VU nationally does not meet CR/EN threshold).
<i>Cervus hanglu bactrianus</i> — Bukhara deer	CR (IUCN)	Facility: Confirmed (km 35)	Active managed breeding facility at Dashtaro village, km 35, under Sari Khosor Natural Park superintendence (confirmed by CEP letter, December 2024). Not present in the wild corridor. Confirmed PBF receptor under CHA. See also Section 6.2.2.

Source: Latifi (2026); March 2026 field survey; Red Data Book of the Republic of Tajikistan (2024); IUCN Red List (v2025-2); CEP letter (December 2024).

Summary and Survey Completeness

The biodiversity baseline for the BSK Project is well-established for aquatic ecology (Shamsiddinov 2025) and for the broad flora and fauna of the wider area (Latifi 2026), and has been substantially advanced by the May 2026 active-season mobilisation. The May surveys field-confirmed, within the



corridor, the two Critically Endangered wild pear species and *Malus sieversii*; breeding Egyptian Vulture (six nests, one in the works zone) and, for the first time, breeding Cinereous Vulture; Eurasian Otter (sign record near Shoidon); and European Glass Lizard. These results, summarised in the taxon sections above, refine but do not overturn the CHA conclusions; no Critical Habitat trigger is newly activated. The following survey elements remain outstanding and will be completed before, or as a condition of, construction:

- Stage 3 cliff-nesting raptor presence/absence survey for the PBFs not yet field-confirmed (Saker Falcon, Bearded Vulture, Barbary Falcon nesting, Eastern Imperial Eagle), and riparian specialists (Little Forktail, Yellow-eyed Pigeon);
- Targeted pre-construction botanical survey of the engineered footprint for early-flowering Red Book geophytes;
- Active-season reptile survey for European glass lizard and other EN/VU reptiles;
- Pre-construction otter holt survey at the Shahidon bridge before any bankside clearance or in-river works commences.

6.3. Socio-economic Environment

6.3.1. Population and Settlements

The road corridor passes through or in close proximity to 19 settlements distributed across two jamoats — Baljuvon Jamoat in the lower section and Sari Khosor Jamoat throughout the majority of the corridor. An estimated 6,000 residents live directly along the road alignment, with a broader catchment population of approximately 30,000 in the surrounding Baljuvon district area. The RP socio-economic survey identified 116 directly affected parcels across these settlements, with Shaidon (35 affected parcels) and Toydara (31 affected parcels) representing the most significantly affected communities. The distribution of settlements and affected parcels by jamoat is summarised in Table 39 below.

Table 39: Settlements Along the BSK Corridor by Jamoat

Jamoat	Settlement	Affected Parcels
Baljuvon Jamoat	Baljuvon	6
Sari Khosor Jamoat	Shaidon	35
	Toydara	31
	Dahanshighak	6
	Dashti Kilko	5
	Dashtaro	5
	Nusay	5
	Mulokoni	5
	Khorma	4
	Doshmandi	4
	Bogi Zogon	3

Jamoat	Settlement	Affected Parcels
	Safedrokh	2
	Chiltori	2
	Peshtova	2
	Pogula	2
	Ulang	1
	Shomushakh	1
	Shipdara	1
	Dashtighaz	1
Total	19 settlements	116

Source: RP Socio-economic Survey, 2026

In several locations, residential buildings and plots are situated directly adjacent to the existing road edge, reflecting the constrained topography of the valley setting and the absence of formal planning controls along the corridor. This proximity of residential use to the carriageway is a significant baseline safety concern, particularly in Toydara and Shaidon where buildings are reported to be built almost to the road edge.

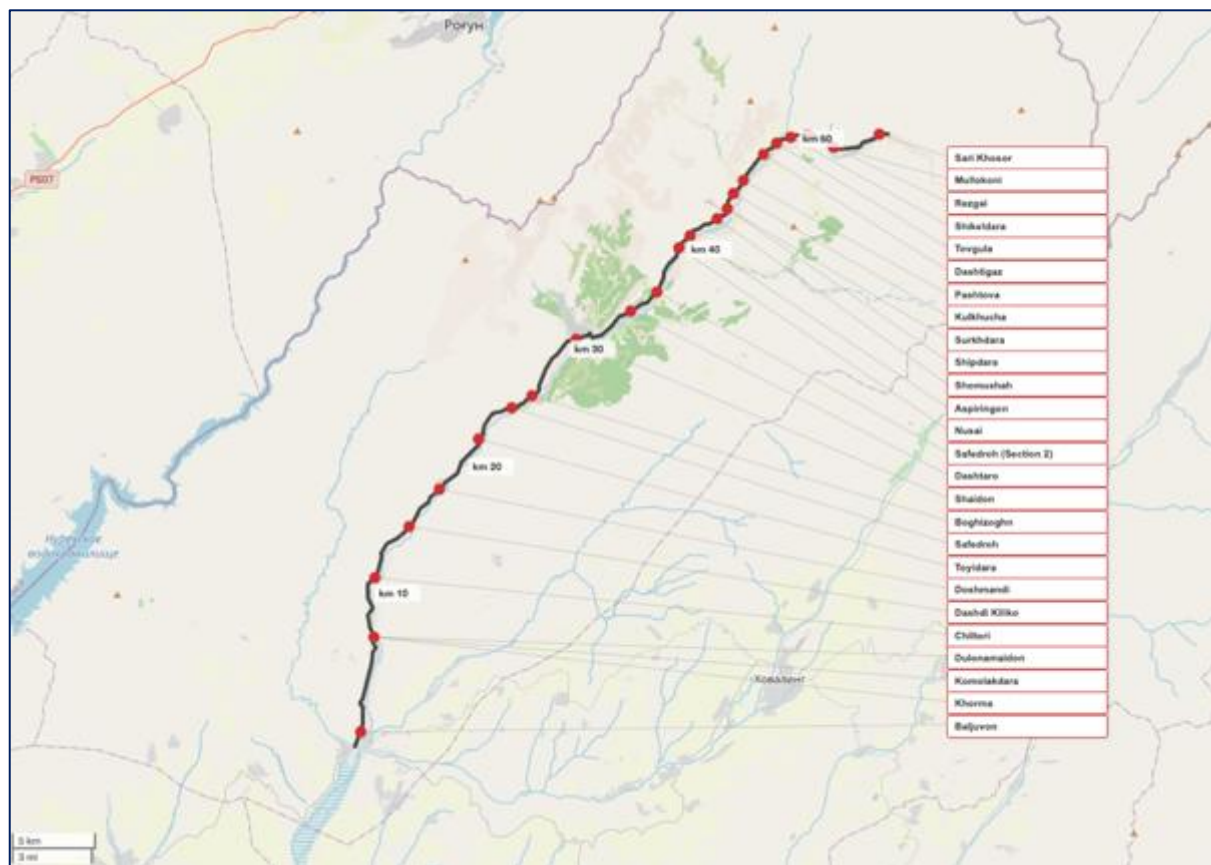
Household Structure and Size - Household structure along the corridor is characterised by large, multi-generational extended families. The RP socio-economic survey recorded data from 110 households with complete size information, yielding a mean household size of 7.7 persons, with individual households ranging from 2 to 21 members. Approximately 60% of all surveyed households comprise 7 or more members. The distribution of household sizes is presented in Table 40 below.

Table 40: Household Size Distribution

Household Size	Number of Households	Percentage
1–3 persons	8	7%
4–6 persons	36	33%
7–10 persons	50	45%
11 or more persons	16	15%
Total	110	100%

Source: RP Socio-economic Survey, 2026

Figure 45: Settlements in the Project Corridor



Source: Vista Environment, 2026

Age Profile - The age profile of the directly affected population is notably young, consistent with demographic patterns observed more broadly in rural Tajikistan. Analysis of individual-level age data recorded for 737 household members confirms that children under the age of 7 account for 15.9% of the surveyed population, and those aged 7 to 17 a further 21.4%, meaning that children and young people under 18 represent 37.3% of the total. The working-age population (18–64 years) accounts for 61.5%, while those aged 65 and above represent only 1.2% of surveyed individuals — a low share consistent with patterns of premature mortality and male out-migration documented in remote mountainous districts. The median age of the surveyed population is 23 years.

Table 41: Age Profile of the Directly Affected Population

Age Group	Count	Percentage
Under 7 years	117	15.9%
7–17 years	158	21.4%
Total under 18	275	37.3%
18–64 years	453	61.5%
65 years and over	9	1.2%
Total	737	100%

Source: RP Socio-economic Survey, 2026 (individual-level data, n=737 household members)

This high proportion of children and young people is directly relevant to road safety — given the established pattern of settlements and pedestrian activity directly adjacent to the carriageway — and to the sensitivity of communities to any disruption of access to schools and services during construction.

Settlement History and Out-Migration - Settlement patterns along the corridor have been shaped by a combination of historical, climatic, and accessibility factors. During the Soviet period, populations were resettled away from the more isolated upper sections of the valley due to the absence of adequate road access. Following the collapse of the Soviet Union, many households returned to their original communities, repopulating settlements that remain poorly connected and difficult to access. Community consultations conducted in 2023 confirmed that seasonal isolation and out-migration remain defining features of life along the corridor, with a householder in Qiozuno settlement describing population decline and winter isolation as longstanding concerns directly linked to poor road access and limited availability of services.

Figure 46: Settlement, KM 24



Source: Vista Environment, 2026

Labour out-migration is a significant feature of household economics along the corridor. Of surveyed households, 7 reported having at least one family member working outside Khatlon Oblast, predominantly in Russia. These households collectively received approximately 212,000 TJS in remittances during 2025, averaging approximately 30,300 TJS per migrant-sending household — a meaningful income supplement relative to the median household monthly income of approximately 4,000 TJS recorded in the survey (RP Socio-economic Survey, 2026). The combination of out-migration and seasonal depopulation means that the resident population along the corridor is disproportionately composed of older people, women, children, and other household members with more limited mobility and fewer livelihood alternatives.

Figure 47: Settlement, KM 28



Source: Vista Environment, 2026

6.3.2. Land Use

Land use within the Project area of influence is predominantly rural and mixed, reflecting mountainous terrain, river valleys, and long-standing patterns of settlement and resource use. The road corridor passes through a combination of agricultural land, pasture, forestry land, residential plots, and existing road infrastructure, with land use strongly influenced by topography and proximity to watercourses.

The RP socio-economic survey identified 116 directly affected land parcels with a combined total affected area of approximately 54.6 hectares. The breakdown of affected parcels by land type is summarised in Table 42 below.

Table 42: Affected Land Parcels by Land Type

Land Type	Parcels	Affected Area (m ²)	Affected Area (ha)	Mean Area per Parcel (m ²)
Residential / household plot	52	10,633	1.06	204
Agricultural land	38	26,823	2.68	706
Pasture	18	364,395	36.44	20,244
Dehkan farm	1	118,600	11.86	118,600
Orchard / garden	5	22,430	2.24	4,486
Commercial	1	15	0.00	15
Total	116	546,044	54.60	4,707

Source: RP Socio-economic Survey, 2026. Figures represent affected portions only; no parcel is fully acquired.

Agricultural land is concentrated in valley bottoms and terraced areas and includes individual dehkan farms (15 parcels), collective dehkan farms (3 parcels), household plots, and small orchards. The 38 directly affected agricultural parcels cover a combined affected area of approximately 2.68 ha, cultivated primarily with vegetables (38 plots) and wheat (29 plots). A total cultivated crop area of approximately 11.5 ha is recorded across affected parcels. Of the 116 affected parcels, only 9 (8%) are



currently irrigated, with irrigation provided through pipe-based systems; four of these report that the Project will affect irrigation access, requiring careful reinstatement during construction. Agricultural land is predominantly used for a combination of crop cultivation and pasture (41 parcels), reflecting the multi-purpose character of rural land management.

Pasture accounts for the largest component of total affected area — 364,395 m² (36.4 ha) across 18 parcels — reflecting the extensive character of pastoral land use on surrounding slopes and upland areas. Pasture is used seasonally for livestock grazing, an important livelihood activity particularly in sections where crop cultivation is constrained by steep terrain.

Forestry land (Лесхоз) is recorded across 44 parcels with a combined affected area of approximately 3.9 ha. This land is predominantly state-managed and leased to households under short-term arrangements, supporting grazing, fuelwood collection, and limited tree cultivation. Forestry land is an important component of local land use systems, particularly in the upper sections of the corridor.

Residential and settlement land comprises 52 affected parcels with a mean affected area of only 204 m² per parcel, reflecting the partial and localised nature of residential land impacts. The small individual areas confirm that impacts on residential plots are principally at plot boundaries rather than involving the loss of dwelling structures — consistent with the finding that no residential structures are physically displaced by the Project.

Trees and perennial plants: Approximately 3,080 trees and perennial plants are affected across the corridor. Fruit trees dominate (approximately 2,943 fruit trees and seedlings), with species including apple, apricot, mulberry, walnut, almond, cherry, grape, pear, plum, pomegranate, and quince. Non-fruit trees, predominantly silver poplar, are also present. The livelihood significance of affected tree crops is discussed further in Section 6.3.3.

Land tenure across affected parcels is characterised by a mix of permanent land use rights (72 parcels, 62%) and short-term leases (43 parcels, 37%). Sixty-four percent of affected parties hold title or lease documentation; 36% do not, which has implications for the RP compensation verification process. Affected parties report long-established use of their plots, with 41% having used the affected land for 20 or more years.

Table 43: Land Tenure Profile of Affected Parcels

Tenure Type	Parcels	Percentage
Permanent land use rights	72	62%
Short-term lease	43	37%
Mixed / other	1	1%
Total	116	100%

Source: RP Socio-economic Survey, 2026

The road corridor itself constitutes a linear disturbed land use, including the existing road formation, cut and fill slopes, drainage structures, and roadside areas.

6.3.3. Livelihoods and Local Economy

Livelihoods in the Project area are predominantly land-based and rural, with households relying on a combination of wage labour, agriculture, livestock rearing, forestry-related activities, and remittances. The RP socio-economic survey collected income data from 100 directly affected households, revealing a median monthly household income of approximately 4,000 TJS and a mean of 8,686 TJS — a significant gap between median and mean driven by a small number of higher-income households. Mean per-member monthly income is approximately 605 TJS. Average monthly household

expenditure is approximately 3,800 TJS at median, with food representing the single largest expenditure category (mean 3,653 TJS per month among reporting households).

Table 44: Monthly Household Income by Source

Income Source	Households Reporting	% of Surveyed HHs	Mean Monthly Income (TJS)
Salary / wages	48	48%	2,336
Other labour income	71	72%	3,087
Agriculture / livestock	41	41%	1,473
Remittances	6	6%	2,830
Pension	12	12%	471
Business / entrepreneurship	7	7%	2,043
Social allowance	3	3%	467

Source: RP Socio-economic Survey, 2026. Note: households may report multiple income sources; percentages sum to more than 100%.

Agriculture is reported as a primary or supplementary income source by 41 of 100 surveyed households (41%), with a mean monthly agricultural and livestock income of 1,473 TJS. Crops grown on affected land are predominantly vegetables (38 plots) and wheat (29 plots), cultivated primarily for household consumption with limited surplus for sale. Of the 42 households confirming their ability to continue agricultural activities, all indicate they can do so on the same land — consistent with the RP finding that impacts are partial and no agricultural parcel is fully acquired.

Livestock is widely kept along the corridor, with cattle (56 recorded entries), donkeys (47), poultry (42), sheep and goats (41), and horses (8) the principal types recorded in the RP database. Livestock is kept predominantly for personal use (151 entries), with a proportion also sold as live animals. Livestock rearing on communal pasture and forestry land is an important livelihood activity, particularly where crop cultivation is limited by steep terrain.

Tree crops represent an important source of long-term household income and food security. Approximately 2,943 fruit trees and seedlings are affected across the corridor, with species including apple, apricot, mulberry, walnut, and quince. Loss of productive trees — which may have taken many years to reach productive age — represents a significant and long-duration livelihood impact that is addressed through the RP compensation and livelihood restoration framework in accordance with EBRD ESR5.

Non-farm income sources include wage labour (the most commonly reported income source, with 48 households reporting salary income and a further 71 reporting other labour income), small-scale trade and business (7 households), and pension income (12 households). Employment opportunities within the Project area are constrained by poor road access, seasonal isolation, and limited market integration. On average, households report two income-generating members.

Remittances and out-migration provide a supplemental but significant income source for a minority of households. Six households report remittance income with a mean of 2,830 TJS per month, and seven households confirmed having members working outside Khatlon Oblast — primarily in Russia. These households collectively received approximately 212,000 TJS in remittances during 2025. While remittances represent only a small share of the total affected population, they are a critical income

source for the households that depend on them, and the loss of a family member to migration simultaneously removes a labour resource from the household while providing a financial transfer.

Income seasonality is a feature of household economics along the corridor. Of those households reporting seasonality data, income is higher in summer and autumn for the majority, consistent with the concentration of agricultural and construction labour income in the warm season. The combination of seasonal income peaks and winter road closures means that winter represents the most economically constrained period for many households, when both income and access to markets are reduced simultaneously.

Table 45: Monthly Household Expenditure by Category (Mean, Reporting Households)

Expenditure Category	Households Reporting	Mean Monthly (TJS)
Food	99	3,653
Housing maintenance	99	760
Transport	99	642
Business / farm inputs	68	744
Clothing	99	561
Health	99	412
Education	91	395
Communications	98	236

Source: RP Socio-economic Survey, 2026

Livelihood vulnerability is influenced by landholding size, dependence on natural resources, limited income diversification, and exposure to climatic and access-related risks. Even partial loss of land or productive tree assets has the potential to result in material livelihood impacts, particularly for households in the lower income brackets where agricultural and natural resource income represents a primary rather than supplementary livelihood source.

6.3.4. Access to Services

Transport Infrastructure and Road Access

The BSK road is the sole surface transport link connecting communities along the corridor with the district centre at Baljuvon and beyond. No alternative paved route exists for the approximately 6,000 residents and 860 households in the two jamoats along the 56 km corridor. The road was originally constructed in the 1960s, but exists today as an unpaved earth and gravel track, passable only by four-wheel drive vehicles. Current traffic volumes are approximately 100 vehicles per day.

Under these conditions, travel time from Baljuvon to Shahidon — the principal administrative centre along the corridor at approximately km 31 — exceeds two hours for the 31 km distance. Communities beyond Shahidon, in the upper valley approaching Sari Khosor hotel, face substantially longer and less predictable journey times dependent on seasonal river levels. Road condition data confirm that the existing alignment does not meet any of the applicable design standards for road construction, including minimum curve radii, gradient, drainage provision, and carriageway width.

The alignment is subject to frequent disruption from natural hazards characteristic of the mountainous terrain, including landslides, mudflows, debris flows, rockfall, and snow accumulation, which periodically close sections of the road and leave communities temporarily isolated. Isolation is

particularly severe in winter and has historically driven out-migration. During the Soviet period the absence of reliable road access led to the involuntary relocation of most valley residents to neighbouring lowland areas; communities returned after 1991 but the underlying access constraints remain. Stakeholder consultation conducted at Qiozuno settlement in June 2023 confirmed that seasonal isolation and difficulty accessing schools and health services continue to drive ongoing out-migration among working-age adults.

Existing settlements have no roadside pedestrian infrastructure. There are currently no sidewalks, drainage flumes, street lighting, or bus stops along the corridor. Fences, residential buildings, and other structures are located directly at the road edge in many settlement areas, creating serious pedestrian safety hazards that are exacerbated by the absence of delineation or speed control measures. The Road Safety Audit confirms these conditions and notes that the absence of pedestrian infrastructure is a high-risk baseline deficiency across the corridor. This context is directly relevant to road safety conditions: nationally, 42% of road crash fatalities in Tajikistan in 2021 were pedestrians and cyclists, significantly above the Asia-Pacific average of 31%, reflecting the systemic absence of pedestrian provision on roads of this type.

Figure 48: Road Condition – Approximately KM 5



Source: Vista Environment , January 2026

Figure 49: Road Passing through River Bed



Source: Vista Environment , January 2026

Electricity

Grid electricity infrastructure is present along the corridor, supplied via transformer substations operating at 10/0.4 kV. The presence of these substations confirms that at least some communities have grid electricity access, and that the network has sufficient capacity to support road lighting over the alignment.

All villages along the corridor are connected to the grid electricity supply network. However, supply reliability is limited during the winter months due to poor grid stability, resulting in intermittent outages during the period of greatest household energy demand. One confirmed case of off-grid electricity provision — a 20 kW micro-hydro power station at approximately km 17.7, previously supplying villages in the mid-corridor area — is recorded in the RP as a former state-owned facility that is currently non-operational. This indicates that grid supply has not been consistently reliable across all communities historically, and that small-scale, off-grid generation has filled gaps in coverage. The seasonal instability of the existing grid supply is a relevant consideration for the operational phase, as the road lighting installation will depend on a network that is known to be subject to winter outages.

Water Supply

Piped water supply infrastructure is present in settlement areas along the corridor. The detailed design for the road upgrade includes the replacement of an existing water pipeline in settlement zones, using polyethylene and steel pipes sized between 32 mm and 280 mm diameter, indicating that a networked supply system predates the project and serves communities in at least the lower and middle sections of the corridor. However, there is no centralised water supply network across the villages as a whole. Most households rely primarily on spring water conveyed to settlements through small, locally managed pipeline systems, supplemented in many cases by private wells within household plots. In addition, communities draw on springs, river intakes, and irrigation channels fed by the Shurobdaryo and its tributaries for both domestic and agricultural use. Community-level intake structures and irrigation channels are known to exist at multiple points along the alignment.



Education

School provision along the corridor is limited and unevenly distributed. Secondary schools operating up to Grade 11 are confirmed at Shahidon (approximately km 31), Khorma, and Doshmandi. Shahidon is the principal administrative centre for the mid-corridor area and, as the only settlement with a surfaced road, functions as the primary village for services for communities in the valley. Elementary schools providing education to Grade 4 are present in Toydarra, Chiltori, and Dashti Kilko. A school facility is also noted at Peshtoba (approximately km 46).

A secondary school at Aspiringon village (approximately km 41), is situated on the eastern bank of the Shurobdaryo opposite Nusai village. Under baseline conditions, access between the road-side bank and this school requires crossing the river; the project design includes a pedestrian bridge at this location specifically to provide reliable access.

Children from smaller settlements without schools must travel to the nearest available facility, in many cases walking distances of approximately 5–6 km along the riverside road. This journey is particularly hazardous during winter and periods of adverse weather, when the existing road is in poor condition and river levels are elevated. For communities in the upper valley — beyond km 36, where no formed road currently exists — access to even the nearest confirmed secondary school at Shahidon requires travel along a route that is difficult and seasonally impassable.

Health Facilities

A medical facility at Shahidon (approximately km 31) serves as the principal healthcare facility for communities throughout the corridor. In addition, smaller health points and medical centres providing basic outpatient services are present in several other villages, consistent with the typical rural Tajikistan model of primary care delivery through a network of feldsher-midwife points (FAPs) at village and jamoat level, with referral to district-level facilities at Baljuvon for secondary and emergency care. No further facilities beyond those at Shahidon have been confirmed as providing inpatient or emergency care.

Emergency medical evacuation, ambulance response, and access to the hospital at Shahidon are materially constrained or impossible during adverse weather and river conditions. This represents a serious baseline health risk, particularly for obstetric emergencies, acute illness, and trauma, and is one of the primary development justifications for the Project.

Markets, Administrative Services, and Regional Connectivity

Access to markets, administrative services, and the wider regional economy is entirely dependent on the BSK road. The district administrative centre at Baljuvon, located at km 0, is the primary destination for administrative functions including land registration, legal services, and higher-level government interaction. The regional centre at Bokhtar (the capital of Khatlon Region) is accessible from Baljuvon via the previously rehabilitated Kangurt–Baljuvon road. The poor condition of the BSK road effectively disconnects upper-valley communities from market access: due to the absence of reliable road access, most agricultural products are consumed locally or wasted rather than sold at markets in Kulob, Bokhtar, or Dushanbe. Mobile and internet connectivity in this remote mountain valley is limited, but no data on coverage or access is available.

Basic Utilities

Baseline conditions for access to basic household utilities among directly affected households reflect the remote and rural character of the corridor. The RP socio-economic survey recorded utility data for 98 households. All 98 are connected to the electricity grid, consistent with the existing transmission infrastructure described above. Water supply is universally from rainwater and natural sources — springs, rivers, and tributary streams — confirming the absence of a centralised piped water supply system. Sanitation is universally provided by pit latrines outside dwellings. Gas supply is predominantly through LPG cylinders (89 households, 91%), with only 9 households (9%) having access to piped natural gas. Winter heating relies entirely on wood and coal. These baseline utility conditions



are directly relevant to the ESMP's requirements for construction camp design — the camp facilities must be self-sufficient and must not place additional demand on community water, sanitation, or energy resources.

Table 46: Baseline Utility Access — Directly Affected Households (n=98)

Utility / Service	Predominant Type	Households	%
Water supply	Rainwater / natural source (river, spring)	98	100%
Sanitation	Pit latrine outside dwelling	98	100%
Electricity	Connected to electricity grid	98	100%
Gas supply	LPG cylinders	89	91%
Gas supply	Piped natural gas	9	9%
Winter heating	Wood / coal	98	100%

Source: RP Socio-economic Survey, 2026

6.3.5. Gender

Gender Composition and Household Structure

Gender composition data from the RP socio-economic survey confirms that male household heads predominate along the corridor, accounting for 83.7% of surveyed household heads (82 of 98 households with complete gender data). Female-headed households represent 16.3% (16 households), of which the majority are headed by widows or by women whose husbands are working outside the district — a profile consistent with patterns of male labour out-migration documented in the region (PIURR, 2023). In terms of overall household membership, the gender split is broadly even, with men accounting for approximately 52.7% and women 47.3% of the directly affected population (RP Socio-economic Survey, 2026).

Educational attainment among household heads is relatively high for a remote rural setting. Of 98 household heads with recorded education data, 52% have completed secondary education, 27% hold a higher education qualification, and 20% have vocational or technical training. Only 1% reported primary education only, reflecting the legacy of Soviet-era universal education provision.

Table 47: Education Level of Household Heads

Education Level	Number	Percentage
Primary / incomplete secondary	1	1%
Secondary (complete)	51	52%
Vocational / technical	20	20%
Higher education	26	27%
Total	98	100%

Source: RP Socio-economic Survey, 2026

Women's Access to Services and Health



Access to health services represents one of the most acute gender-differentiated baseline vulnerabilities along the corridor. The only confirmed health facility along the 56 km route is a hospital at Shahidon (km 31). Primary health care in rural Tajikistan is typically delivered through feldsher-midwife points (FAPs) at village and jamoat level, with referral to district-level facilities at Baljuvon for secondary and emergency care. However, for communities in the upper valley — approximately the 20 km stretch between Dashtaro (km 36) and Mullokoni (km 54) emergency medical evacuation is materially constrained or impossible during adverse weather and river closure periods.

Obstetric emergencies — including complications in childbirth, haemorrhage, and eclampsia — require rapid access to facility-based care to avoid serious maternal harm. The road conditions along the upper corridor make such access extremely difficult or impossible during the seasons when the road is closed or passable only by four-wheel drive in dry conditions. This represents a serious pre-existing health risk disproportionately borne by women of reproductive age in upper valley communities.

Access to education is similarly constrained in ways that affect girls and boys differently at community level. School provision is concentrated at Shahidon (km 31) and Aspiringon (km 41). For communities beyond km 36 where no formed road currently exists, access to even the nearest school requires travel along a difficult and seasonally impassable route. In rural Tajikistan, where gender norms continue to influence household decisions about girls' schooling, poor physical access is a known risk factor for lower female educational attainment, particularly at secondary level. No disaggregated school enrolment data for the corridor communities is available in existing documentation.

Livelihoods and Economic Participation

Livelihoods along the corridor are predominantly land-based, with households relying on smallholder agriculture, livestock, and tree crops. While formal data on gender-disaggregated land ownership and labour division are not available from the existing baseline surveys, national and regional patterns in Tajikistan indicate that women's access to formal land title is lower than men's, and women's participation in formal labour markets is constrained by a combination of legal provisions (including the Labour Code prohibition on night work, which limits female employment in certain roles) and prevailing social norms. In practice, women in the Project area are likely to bear primary responsibility for domestic food production and subsistence agriculture while men undertake more physically demanding or market-facing labour activities.

Female-headed households face a specific economic vulnerability in this context: without a male household head to engage in wage labour, FHHs are more dependent on land productivity and access to communal resources, and less able to absorb temporary income shocks such as those associated with crop loss during construction or restrictions on access to agricultural land.

Limited access to markets represents a further economic constraint with a gender dimension. The Project area's geographic isolation means that most agricultural produce is consumed locally or wasted rather than sold, limiting income generation for all households. For women managing households in the absence of male income-earners, this market isolation compounds the limited diversification of livelihood options.

GBV and SEA/SH Baseline Context

The national legal and policy framework for gender-based violence (GBV) includes the Law on the Prevention of Domestic Violence (2013) and associated amendments to the Code of Administrative Offences. The Women's Committee operates 110 regional information-consultation and crisis centres nationally, including within Khatlon Region. Notwithstanding this framework, Tajikistan's national data indicate that domestic violence remains a significant concern in rural areas, with limited reporting rates reflecting social stigma, limited awareness of legal remedies, and restricted access to support services in remote communities. No corridor-specific prevalence data for GBV is available in existing documentation.



The introduction of a contractor workforce for road construction creates a specific and foreseeable risk of sexual exploitation and abuse (SEA) and sexual harassment (SH) in communities along the corridor. This risk is driven by the presence of a relatively large, predominantly male, non-local workforce in close proximity to communities with pre-existing economic vulnerability and limited institutional support structures. The scoping assessment for the Project identified GBV/SEA/SH as a scoped-in impact topic with an area of influence extending to communities within approximately 15–20 km of construction camps and active work areas — a precautionary perimeter consistent with EBRD guidance on SEA/SH risk management in linear infrastructure projects, where workforce mobility means risks are not confined to the immediate works area. A dedicated SEA/SH Action Plan is required as a component of the Project ESMP.

The pre-existing social context is relevant to this risk assessment. The combination of male out-migration, female-headed and economically isolated households, limited access to services, and weak institutional presence along the upper corridor creates conditions in which women and girls may be particularly vulnerable to coercive or exploitative interactions with a non-local workforce. The baseline GBV risk environment should be characterised in further detail through the SEA/SH risk assessment to be conducted as part of the ESMP development process.

6.3.6. Vulnerable Groups

Vulnerability assessment is a core requirement under EBRD ESR5 and ESR10. The RP socio-economic survey applied a structured vulnerability screening framework to all 116 directly affected parties, identifying households meeting one or more of four defined vulnerability criteria: large families, female-headed households, low-income families, and households with a member with a disability. The results confirm that vulnerable groups are a significant presence within the directly affected population and require differentiated mitigation and support measures.

Survey-Based Vulnerability Findings

Of the 116 directly affected parties, 40 (34%) carry at least one vulnerability flag. Nine households (8%) carry two or more vulnerability flags simultaneously, and two carry three or more — indicating a subset of households facing compounded and reinforcing disadvantages. The vulnerability profile by category is summarised in Table 48 below.

Table 48: Vulnerability Profile of Directly Affected Parties

Vulnerability Category	Number of PAPs	% of Total PAPs (n=116)
Large family (5+ children under 18)	20	17%
Female-headed household	17	15%
Low-income family	7	6%
Household member with disability	7	6%
Households with 2+ vulnerability flags	9	8%
Total with at least one vulnerability	40	34%

Note: Some households carry multiple vulnerability flags; individual category totals therefore exceed the total count of vulnerable households. Source: RP Socio-economic Survey, 2026

Large Families

Large families — defined as households with five or more children under the age of 18 — represent the most prevalent vulnerability category, with 20 affected households (17%) meeting this threshold. These households have a mean size of 12.1 persons and an average of 5.8 children under 18,



supported by an average of only 2.7 working members. The high dependency ratio in these households means that any reduction in household income or productive land area — including partial land take associated with the Project — carries a proportionally greater impact on per-capita household welfare than in smaller households. Large family households also face heightened exposure to road safety risks given the number of children present in settlement areas close to the carriageway.

Female-Headed Households

Seventeen affected households (15%) are headed by women, of whom the majority are widows or women whose husbands are working outside the district. FHHs have a slightly smaller mean household size (7.1 persons) and fewer working members on average (1.9 vs 2.1 in male-headed households), while carrying a similar childcare burden. Without a male household head to engage in wage labour or seasonal migration, FHHs are more dependent on land productivity, communal resources, and social support networks. This makes them structurally more sensitive to land take, access restrictions during construction, and loss of tree crops or agricultural assets. The RP compensation and livelihood restoration framework includes specific provisions for FHHs in recognition of this structural vulnerability.

Low-Income Families

Seven affected households (6%) are formally classified as low-income under the RP vulnerability framework. These households report a mean monthly income of approximately 3,026 TJS — substantially below the survey mean of 8,686 TJS and below the survey median of 4,000 TJS. Twelve households (10%) across the full affected population report receiving some form of social assistance or allowance, indicating that state-recognised poverty or disability status extends beyond the seven formally classified low-income households. Low-income households are particularly sensitive to temporary disruptions in agricultural income during construction and to any delays in RP compensation payments, given their limited financial reserves.

Households with Members with Disabilities

Seven affected households (6%) include at least one member with a registered disability. These households face heightened barriers to engaging with the consultation process, accessing compensation services, and adapting to temporary disruption of access and livelihoods. The ESMP and RP must ensure that engagement and compensation procedures are accessible to households with disabled members, including provision of accessible meeting formats and individual outreach where standard consultation approaches are insufficient.

Elderly-Headed Households

While elderly-headed households are not a separately flagged category in the RP vulnerability framework, age data from the RP survey reveals that 21% of household heads (21 of 98 with recorded age data) are aged 60 or over — including 4 aged 70 or above. The mean age of household heads is 49 years. Elderly household heads, particularly those managing households in the absence of working-age family members due to out-migration, may face reduced physical capacity, lower income-generating ability, and greater difficulty navigating administrative compensation processes. The ESMP community liaison approach should include specific measures to identify and support elderly-headed households during construction.

Table 49: Age Profile of Household Heads

Age Group	Number	Percentage
Under 30	5	5%
30–39	25	26%

Age Group	Number	Percentage
40–49	23	23%
50–59	26	27%
60–69	15	15%
70 and over	4	4%
Total	98	100%

Source: RP Socio-economic Survey, 2026

Social Assistance

Twelve households (10%) across the affected population currently receive social assistance or allowances from the state. This indicates a minimum floor of formally recognised economic vulnerability within the affected population, though the actual rate of vulnerability is likely higher given that social assistance programmes in rural Tajikistan have limited reach and many eligible households do not receive support.

Ethnicity

All 116 surveyed affected parties identified as Tajik. No ethnic minority groups were identified within the directly affected population, consistent with the ESR7 screening finding that no indigenous peoples as defined under EBRD ESR7 are present within the Project area of influence.

Regional and National Poverty Context

The project-level vulnerability findings are consistent with the broader socio-economic context of Khatlon Region. While Tajikistan reduced its national poverty rate from approximately 56% in 2010 to around 20% in 2023 (World Bank, 2024), spatial disparities persist, with Khatlon hosting a disproportionate share of the rural poor due to geographic isolation, limited job creation, and constraints on agricultural productivity and service access. Household survey evidence for the region indicates that more than a quarter of households remain poor, and a substantial share move in and out of poverty over time — reflecting precarious livelihoods that are sensitive to income shocks and offer limited diversification. Households with larger family size, fewer livelihood sources, and more remote locations are consistently more likely to experience poverty, and women in rural households face persistent barriers to improved dietary diversity and income opportunities.

6.3.7. Tourism

Overview and Regional Context

Tourism within the Project area is an emerging sector in Baljuvon District and the wider Khatlon Region, characterised by a strong natural asset base but significant constraints on development, of which accessibility is primary. The area's mountainous terrain, river valleys, and relatively undisturbed natural environments provide the foundation for nature-based and eco-tourism, and the Sari Khosor area in particular is recognised at both district and regional levels as a priority destination for tourism development.

At the national level, the Committee for Tourism Development under the Government of the Republic of Tajikistan, together with regional tourism development offices in Khatlon Region, are responsible for tourism policy and promotion. Baljuvon District falls within a zone identified for tourism and recreation development, reflecting recognition of its landscape and ecological assets and their potential contribution to regional economic diversification. In mountainous areas of Tajikistan more

broadly, accessibility remains the dominant constraint to tourism growth, and within this context the BSK road corridor is widely regarded by local stakeholders as an enabling investment.

Key Tourism Assets

The principal tourism asset within the Project area is the Sari Khosor waterfall and its immediate surroundings, which effectively constitute the endpoint and principal draw of the road corridor. The waterfall is situated within a mountainous and forested landscape and is recognised as one of the most significant natural features in the region for visitor appeal.

The Shurobdaryo valley provides additional tourism value through its riverine landscapes, forested slopes, and open natural areas suitable for informal recreation including hiking, picnicking, and nature observation. These characteristics are consistent with eco-tourism and adventure tourism.

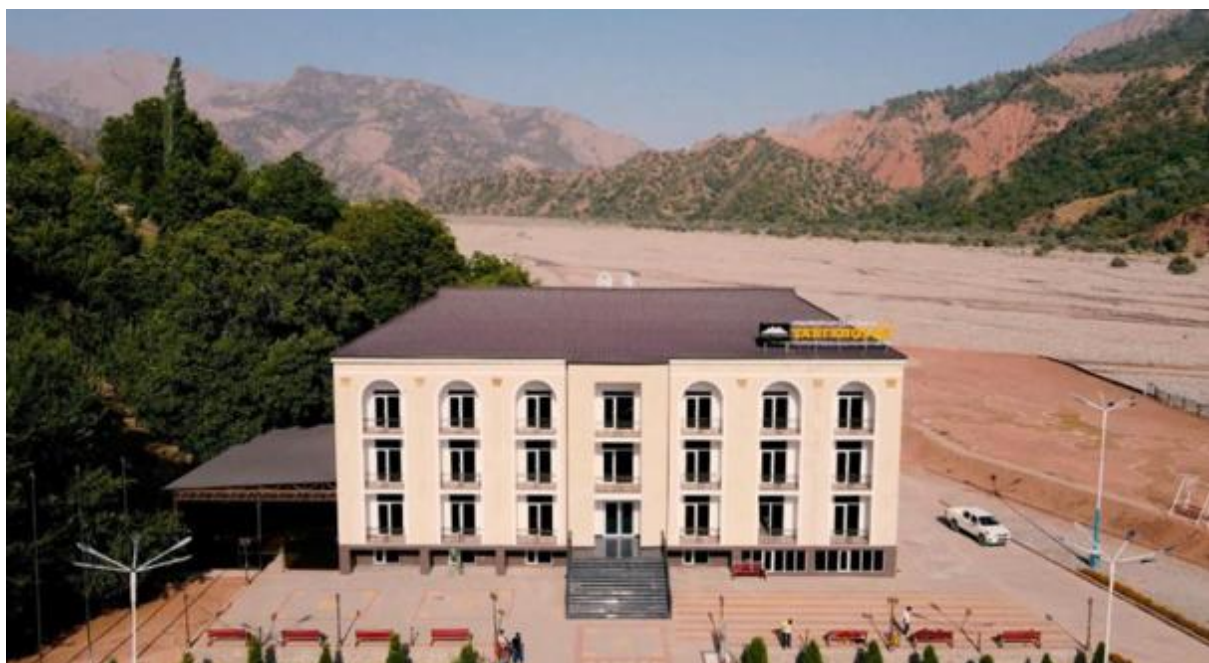
The proximity of the Project area to the Sari Khosor Nature Park is a further component of its tourism profile. The park's ecological value — including documented presence of rare and protected species — contributes to the area's attractiveness for visitors interested in biodiversity-rich and relatively undisturbed environments.

Cultural and historical assets, including long-established settlements and sites of historical significance, provide supplementary potential for cultural and heritage tourism, though this remains undeveloped at present.

Current Tourism Activity and Infrastructure

Tourism in the Project area is currently low-volume and primarily seasonal, with activity concentrated among domestic visitors and a limited number of international visitors seeking remote and nature-based experiences. Stakeholder consultation conducted in May 2023 with the manager of the hotel at Sari Khosor confirmed the tourism potential of the area while noting that the poor condition of the existing road is the primary constraint limiting year-round access and visitor numbers. Existing accommodation infrastructure is limited to this hotel facility at the northern end of the corridor, supplemented by informal rest points and campsites. No structured visitor facilities, formal trails, or organised tour operations have been identified along the corridor.

Figure 50: Sari Khosor Hotel



Seasonality and Accessibility Constraints

Access to the Sari Khosor area is highly seasonal. The existing unpaved road requires four-wheel drive vehicles, is susceptible to disruption from landslides, flooding, and snow accumulation, and is frequently impassable during winter months. As a result, meaningful tourism activity is confined to the summer period. This strong seasonality constrains visitor numbers, limits the viability of tourism-related businesses, and restricts employment generation from the sector.

6.3.8. Cultural Heritage

The cultural heritage baseline was developed to identify and characterize the types of tangible and intangible cultural heritage receptors that could be impacted by the proposed Project. EBRD PR 8 defines tangible and intangible cultural heritage as follows:

- **Tangible cultural heritage:** movable or immovable objects, sites, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic or other cultural significance.
- **Intangible cultural heritage:** practices, representations, expressions, knowledge, skills – as well as the instruments, objects, artefacts and cultural spaces associated therewith – that communities, groups and, in some cases, individuals recognize as part of their cultural heritage, and which are transmitted from generation to generation.

Tangible and intangible cultural heritage resources can be further divided into different receptor types. Tangible cultural heritage receptors are typically classified into one of four categories: archaeological, paleontological, built heritage, or living heritage (Table 50). The United Nations Educational, Scientific and Cultural Organization (UNESCO) has established five categories or “domains” of intangible cultural heritage receptors: knowledge and practices concerning nature and the universe, oral traditions and expressions; performing arts; social practices, rituals and festive events; and traditional craftsmanship (Table 50).

Table 50: Types of Tangible and Intangible Cultural Heritage Resources

Cultural Heritage	Resource Type	Definition
Tangible Cultural Heritage	Archaeological Resources	Concentrated and patterned physical remains of past human activity. A resource may include artefacts, plant and animal remains, structural remains, and soil features. Archaeological resources may be significant to local, regional, national, or international stakeholders due to their perceived cultural, historical, artistic, or scientific value.
	Paleontological Resources	Any fossilized remains, traces, or imprints of organisms, preserved in or on the Earth’s crust, which are of paleontological interest and provide information about the history of life on Earth
	Built Heritage Resources	Culturally, architecturally, artistically, or historically significant buildings or structure such as government buildings, residences, temples, churches, mosques, monasteries, roads, railroads, bridges, walls, mines, etc.
	Living Heritage Resources	Living heritage resources are structures, locations, environmental resources, and/or natural landscape features that are actively used by stakeholders as part of a living cultural tradition. Environmental receptors and natural landscape features such as trees, forests, rivers, or mountains may be living heritage receptors if they are imbued with cultural values or are places where significant cultural activities take place.

Cultural Heritage	Resource Type	Definition
Intangible cultural heritage	Knowledge and practices concerning nature and the universe	Knowledge and practices concerning nature and the universe include knowledge, knowhow, skills, practices and representations developed by communities by interacting with the natural environment including traditional/indigenous ecological wisdom, knowledge about local fauna and flora, traditional healing systems, beliefs, initiatory rites, cosmologies, shamanism, possession rites, social organizations, festivals, languages and visual arts.
	Oral traditions and expressions	Encompasses an enormous variety of spoken forms including proverbs, riddles, tales, nursery rhymes, legends, myths, epic songs and poems, charms, prayers, chants, songs, dramatic performances and more. Oral traditions and expressions are used to pass on knowledge, cultural and social values and collective memory.
	Performing Arts	The performing arts range from vocal and instrumental music, dance and theatre to pantomime, sung verse and beyond. They include numerous cultural expressions that reflect human creativity and that are also found, to some extent, in many other intangible cultural heritage domains
	Social practices, rituals and festive events	Social practices, rituals and festive events are habitual activities that structure the lives of communities and groups and that are shared by and relevant to many of their members. These practices reaffirm group identity and are closely linked to a community's worldview and perception of its own history and memory.
	Traditional craftsmanship	The skills and knowledge involved in the production of traditional crafts such as tools; clothing and jewelry; costumes and props for festivals and performing arts; storage containers, objects used for storage, transport and shelter; decorative art and ritual objects; musical instruments and household utensils, and toys, both for amusement and education.

The Agency for the Protection of Historical and Cultural Heritage under the government of Tajikistan maintains a national register of over 3,500 historical and cultural heritage sites located across the country. While the government of Tajikistan does not publish the national register, excerpts from official government news stories and publications provide examples of national cultural heritage sites/monuments found in the Khatalon region include the Takhti Sangin archaeological complex, Khoja Mashhad Madrasah and Mausoleum, Batudasht Ancient Town, Khoja Nakshiron Mausoleum, and Muhammad Bashoro Mausoleum, and the Kal'ai Baljuvon³¹. Although this is not an exhaustive inventory, the quantity of registered resources and the existence of nationally recognized archaeological and built heritage receptors in the region indicate a high likelihood of tangible cultural heritage receptors within the Project area.

The following sections provide baseline information for the types of tangible and intangible cultural heritage receptors described in Table 50. Due to the limited cultural heritage baseline information available for the proposed Project area, the cultural heritage baseline includes a variety of local and regional data to characterize both previously identified cultural heritage receptors and receptors that may be present in the Project area.

³¹ (Fergana 2026, NIA 2023).

Archaeological Receptors

The cultural heritage baseline study did not identify any previously recorded archaeological sites along the proposed Project right-of-way. There is, however, limited publicly available information summarizing the results of previous archaeological investigations within the Baljubon – Sari Khosor area. As a result, the archaeological baseline study was focused on identifying the types of archaeological receptors that could be present based on the prehistory and history of the larger Khatlon Region. The results of this research are summarized in Table 51.

Table 51: Khatlon Region Archaeological Context

Period	Description	Archaeological Site Types
Paleolithic-Mesolithic periods (ca. 950,000 – 6,000 BCE)	Khatlon region likely occupied by a variety of archaic/pre-modern humans (<i>H. erectus</i> and <i>H. ergaster</i>) followed by early modern humans (<i>H. sapiens</i>) hunter-gatherers living in small mobile bands.	Open air camp sites, temporary shelters, cave/rock shelters, hearths, pit houses, lithic scatters.
Neolithic-Chalcolithic periods (6,000-3,500 BCE)	Appearance of small farming hamlets around oases, irrigation systems, communal storage, agriculture, herding, and metallurgy expand. Formation of low mounds as mudbrick structures are used, collapse, and built upon.	Individual farmsteads or small hamlets sites containing the remains of early mudbrick houses, storage pits, small tepa (mounds), irrigation channels.
Bronze Age (3,500-1500 BCE)	Rise of fortified compounds and proto-urban with towers, gates, planned quarters; expanded irrigation; long-distance trade. Bronze metallurgy spreads; nomadic cattle-breeding appears. Mountain settlements show mixed cultural groups, wheel-made pottery, bronze scythes, ritual bonfires.	Individual farmsteads and villages dominated by mudbrick architecture. Appearance of fortified compounds, large mudbrick enclosures, planned residential blocks, proto-urban tepa.
Iron Age and Achaemenid periods (1,000-329 BCE)	Iron technology spreads, accelerating social and political development. Khatlon formed part of the Persian Empire's satrapal administrative system characterized by citadels, hilltop fortresses, and expanding irrigation.	Dispersed, mudbrick farming villages, settlements with multi-room mudbrick houses, hilltop fortresses, citadels with bastions, administrative compounds, irrigation works.
Greco-Bactrian (329-100 BCE) & Kushan periods (1 st -3 rd centuries CE)	After Alexander the Great conquers the region, strong cultural fusion between Greek and local traditions. Flourishing urban and religious landscape, with Buddhist monasteries, stupas, and sculptural programs becoming defining features of Tokharistan. Ca. 230 CE, the Sasanians conquered Bactria-Tokharistan and established the vassal state of Kushanshahr.	Small village sites of mudbrick structures. Fortresses with Hellenistic (Greek) modifications, elite residences, mixed ceramic assemblages, coin hoards.
Kushano-Sasanian, Kidarite, Hephthalite periods (3 rd -6 th centuries CE)	Continued urban life under shifting polities; fortified cities, monasteries, Zoroastrian and Buddhist religious structures. Dense landscape of monasteries, stupas, painted halls, sculptural galleries; monasteries as religious and economic hubs.	Urban centers, small villages, large walled monasteries, stupas, painted chambers, sculptural halls, monastic cells.

Period	Description	Archaeological Site Types
Turkic rule (6th-8th centuries CE) and Early Islamic Period (8th-9th centuries CE)	The region experienced renewed development, with the construction of new cities and canals and the flourishing of Buddhism. The adoption of Islam in the region brought administrative reorganization and new religious architecture, but many fortified towns continued to function. Valley sites flourish with Zoroastrian, Buddhist, Christian, and early Muslim communities.	Small village sites of mudbrick structures. Buddhist monasteries and stupas. Palatial complexes, walled towns, sculptural programs. Early mosques, Islamic residential quarters, reused fortresses, abandoned monasteries.
Khuttal kingdom (9 th -15 th centuries CE) and Khanate-Bukhara Emirate (16 th -19 th centuries CE)	Beginning in the 9 th century CE, Khatlon crystallized as the heartland of the centered on Hulbuk, a palace-city with advanced infrastructure and a network of fortified towns, shrines, and caravan routes. This medieval landscape remained active in the 16 th -19 th centuries CE, when Khatlon fell under the influence of regional khanates and the Bukhara Emirate.	Palaces, citadels, mosques, madrasas, Sufi shrines, baths, caravanserais, dense mudbrick housing, fortified towns, and village compounds.
Russian Imperial (mid-19 th - early 20 th centuries CE) and Soviet periods (1917-1991)	Russian imperial rule (introduced new administrative and military structures, followed by Soviet Period collectivization, industrialization, and large-scale agricultural transformation. Many religious and historic structures were repurposed or neglected, while new Soviet towns and infrastructure reshaped the region.	Military forts, Russian administrative buildings, warehouses, traditional mosques/shrines, irrigation works. Kolkhoz/sovkhoz buildings, workers' housing, clinics, schools, repurposed mosques/shrines.

Source: National Museum of Antiquities of Tajikistan (NMAT). "National Museum of Antiquities of Tajikistan." Accessed February 25, 2026. <https://ombt.tj/en>; UNESCO. History of Civilizations of Central Asia. 6 vols. Paris: UNESCO Publishing, 1992–2005.

Table 51 demonstrates the time depth, diversity, and complexity of human occupation of the Khatlon region and, as a result, there is the potential for a variety of archaeological receptors from multiple time periods to be present along the Project route or within other Project areas such as construction camps, laydown areas, and borrow areas. The location, geomorphological characteristics, and current occupations of the proposed Project, however, reduces the potential for intact archaeological deposits across much of the Project area.

A review of publicly available satellite imagery for the proposed Project right-of-way did not reveal evidence of large mounds, ditches, standing ruins, earthen embankments, or other features typically associated with extensive, complex archaeological sites. Furthermore, the project's position within a relatively narrow, steep-sided valley further diminishes the likelihood of encountering significant archaeological sites, given the limited availability of flat, level terrain suitable for sustained occupation.

Within the valley, the proposed Project route runs along the base of steep slopes, often requiring the existing slope to be cut back to create a level corridor for the roadway. Very steep slopes rarely contain archaeological sites because they offer limited stable ground for past human occupation, are prone to erosion and mass-wasting, and do not support the long-term preservation of cultural materials. Soil profiles on steep gradients are typically thin, mobile, and frequently disturbed, preventing the accumulation and stratification necessary for archaeological deposits to form or survive.

Considering these factors, areas within the proposed Project Area with elevated potential for archaeological resources are primarily sections of the road route, construction camps, laydown areas, and borrow areas situated on relatively flat, first terraces overlooking the river channel, as well as

within existing towns and villages similarly positioned on level terrain adjacent to the river. Should archaeological materials be present in these zones, they may include Paleolithic-Mesolithic hunter-gatherer camp sites or remnants of pastoralist encampments, livestock enclosures, and/or small agricultural farmsteads, hamlets, or villages dating from the Neolithic Period through to the 20th century CE. Such farmsteads, hamlets, or villages would likely occupy comparable locations and exhibit similar scales to contemporary communities situated along the proposed Project right-of-way.

The preliminary satellite imagery review conducted during the baseline study appears to confirm the assessment that the relatively flat areas within the towns and villages along the Project right-of-way could contain archaeological receptors. Figure 51 is a satellite image of a section of the proposed Project right-of-way outside of Sari Khosar. The circled area within the image contains what could be collapsed stone foundations of a large, rectangular structure with at least one internal division. While the age or function of these potential remains cannot be ascertained from the image it should be noted that what appears to be more recent abandoned structures are also visible in the satellite imagery and these appear to be made from cinder/breeze blocks or concrete. This suggests the structural remains in Figure 51 are likely older as they are made from field stone.

Figure 51: Possible archaeological receptor (stone features within red circle) adjacent to proposed Project alignment (red line) in Sari Khosar



Built Heritage Receptors

Like the archaeological baseline study, the built heritage baseline study included a review of the built heritage resources of the broader Khatlon region to identify previously recorded receptors in the Project area and to characterize the types of unrecorded resources that could be present. The Khatlon region contains contributing components of the regional Ancient Khuttal UNESCO World Heritage Property. Ancient Khuttal is a serial UNESCO World Heritage property that preserves the political, cultural, and economic heartland of the medieval Khuttal principality in southern Tajikistan. Its twelve

archaeological and built heritage components collectively illustrate the region's role as a crossroads of Iranian, Central Asian, and Silk Road traditions from the early medieval period through the late Middle Ages.³²

The nearest component of the Ancient Khuttal World Heritage resources is the Khishttepa Buddhist Temple located approximately 22 km east of the proposed Project route in the village of Chepivod (Figure 52). The resource consists of a compact 7th–8th c. Buddhist temple which is the only Buddhist site located within the boundaries of the former Khuttal Kingdom. The site, which is considered an archaeological and built heritage site, includes the remains of monastic and religious sections, a central domed hall, sanctuary with altar and niches, corridors with murals and stucco, a votive stupa, over 60 miniature stupas with Brahmi tablets. The remaining 11 components of the resource are located over 30 km to the south and southwest of the proposed Project. None of the 12 components of the UNESCO World Heritage Site will be impacted by the proposed Project.

Figure 52: Ajinatepa Buddhist Monastery: view to the south-east



Source: IICAS 2026. Photograph of Ajinatepa Buddhist Monastery: view to the south-east. Electronic image available at <https://whc.unesco.org/en/documents/220718>. Accessed February 26, 2026

The built heritage baseline identified a single built heritage resource along the proposed Project right-of-way: the Kal'ai Baljuvon, located in Baldzhuvon town about 125 meters northwest of where the road is planned to begin at KM 0.0 (Figure 53). The Kal'ai Baljuvon is a modern reproduction of a traditional 17th century fortress, featuring stone and mudbrick walls, watchtowers, and enclosed courtyards (**Error! Reference source not found.**³³). The fortress formed part of a wider constellation o

32 UNESCO World Heritage Centre. Cultural Heritage Sites of Ancient Khuttal. UNESCO, 2025. Available at: <https://whc.unesco.org/en/list/1627>

33 Travel Tajikistan (TT) 2026. "The Fortress of Miri Baljuwon." Accessed February 26, 2026. <https://traveltajikistan.tj/en/the-fortress-of-miri-baljuwon/>.

f regional strongholds, including Mir, Chorbag, Topkhona, Turk, Dektur, Chanoro, Chavgoni, and Dodi, located on elevated positions overlooking river valleys and trade corridors. While the structure is modern, it represents a traditional hilltop fortification characteristic of southern Tajikistan's defensive architecture and is considered an important historic site.

Figure 53: Kal'ai Baljuvon Fortress (red box) location relative to the proposed Project alignment (red line) in Baldzhuvon



Although the modern reconstruction of the Kal'ai Baljuvon is not considered a significant built heritage receptor as a preserved historic structure, it is a significant receptor as a monument to the early modern history of Baljuvon. The fortress played a significant role in local and regional history as the seat of power for multiple regional emirs and was captured by Abdul Wose and his group of rebellious peasants during the Uprising of the Wose in 1888 (TT 2026). Based on its association with these historic events, the Kal'ai Baljuvon has been formally registered by the government of Tajikistan as a national monument. In addition to its significance as a built heritage receptor, the area around the reconstructed fortress likely contains significant archaeological deposits associated with the historic fortress site and the surrounding village. The area around the fortress, including the portion close to the proposed Project start point, should be considered a high-risk area for archaeological receptors.

In addition to these known receptors, there is the potential for additional unidentified built heritage receptors within the towns and villages along the Project right-of-way. These could include, but are not limited to, traditional Pamiri houses, historic vernacular clay-brick homes, pre-Soviet road markers, stone cairns, or boundary markers, and historic mosques and mausoleums. Stakeholder engagement and/or additional in-field survey would be necessary to identify additional built heritage receptors, if present.

Living Heritage Receptors

The cultural heritage baseline study identified two types of living heritage receptor along the Project right-of-way: a mosque located approximately 37 km from the start of the proposed road and local cemeteries (Figure 54). The mosque was identified through a review of labeled "Places" in Google Earth Pro. The label is like the product of crowdsourced tagging, whereby the location is added by a local user and then confirmed by multiple other users.

Figure 54: Mosque structure (circled in red) in community east of Sari Khosar and located approximately 170 m north of the proposed Project alignment (red line)



The labeled building is a roughly 20 m x 10m structure with an open gable, pitched metal roof with a gabled entrance. The structure is similar in appearance to the surrounding residential structures but has a larger parking area at the front. The labeled structure is located approximately 170 m northeast of the road alignment with the area between the structure and road containing a residential structure and what appears to be planted fruit trees. Assuming the structure is used as a local mosque, Table 52 provides a summary of the daily, weekly, monthly, and yearly religious and cultural activities that could take place within the mosque. All these potential activities could be impacted by Project activities, as noise, air quality (dust), visual impacts, and access restrictions could affect the ability of stakeholders to use the mosque for religious and other cultural practices.

Table 52: Typical Religious Activities Observed at Rural Mosques in Tajikistan

Time Frame	Activity
Daily	Five daily prayers (Fajr, Zuhr, Asr, Maghrib, Isha)
	Individual Qur'an reading and quiet dhikr
	Imam guidance and informal adult discussions
	Funeral (janaza) prayers when needed
Weekly	Friday Jumu'ah prayer and sermon

Time Frame	Activity
	Informal community discussions after Friday prayer
	Mosque cleaning and community maintenance
Monthly	Voluntary fasting days (13th–15th of the lunar month)
	Mosque committee or elder meetings
	Visits to local mazor (shrine)
Yearly	Ramadan fasting and nightly Taraweeh prayers
	Eid al-Fitr prayer
	Eid al-Adha prayer and distribution of sacrificial meat
	Annual charity distribution
	Seasonal mosque repairs (hashar)

In addition to the identified mosque the Initial Environmental Assessment drafted by the Project Implementation Unit for Roads Rehabilitation under the Ministry of Transport of the Republic of Tajikistan states there are small, local cemeteries located alongside the Project route. The location of these cemeteries could not be confirmed during the cultural heritage baseline. Assuming they are present, they are likely locally significant living cultural heritage receptors and additional stakeholder engagement will be necessary to confirm their location, identify when and how they are used by local stakeholders, and evaluate the sensitivity of these receptors.

While the living heritage baseline study did not identify any other receptors, it is likely that there are additional living heritage receptors in the villages along the proposed Project route. Based on the social and religious make-up of the area, these receptors could include, but are not limited due, additional local mosques, madrasas, cemeteries, religious shrines to local saints, and festival/ceremony grounds. Additional stakeholder engagement with local communities is necessary to identify any additional living heritage receptors, if present.

Intangible Cultural Heritage Receptors

The intangible cultural heritage baseline study identified 13 intangible cultural heritage receptors inscribed on the UNESCO Intangible Cultural Heritage Lists that were either nominated by the government of Tajikistan or where Tajikistan is a joint sponsor along with other nations (Table 53). These receptors represent living traditions recognized by the government of Tajikistan as being nationally significant and at the international level as representative of the intangible cultural heritage of humanity. Therefore, each of these intangible cultural heritage receptors, if practiced in the Project Area, are considered significant intangible cultural heritage receptors.

Table 53: UNESCO Listed Intangible Cultural Heritage Practiced in Tajikistan

Intangible Cultural Heritage	Summary
Culture of Sumanak/Sumalak Cooking	Sumanak is a communal Navruz dish made from sprouted wheat, symbolizing spring renewal, unity, prosperity, and good health. Women lead the stirring and

Intangible Cultural Heritage	Summary
	singing while men assist with fire and heavy tasks. Knowledge is passed through families, schools, cultural events, and online sharing.
Navruz	A multinational spring festival celebrating nature, renewal, and social harmony. Communities greet the sunrise, prepare traditional foods, and participate in games, music, and dance. Transmission occurs informally through participation, fostering unity across diverse cultures.
Art of Crafting and Playing Rubab/Rabab	Ancient musical tradition involving the crafting and performance of the rubab, a mulberry-wood string instrument used in ceremonies, rituals, and gatherings. Skills are passed through apprenticeships and family traditions, strengthening cultural identity across Central Asia.
Ceremony of Mehregan	Autumn harvest celebration expressing gratitude for crops and livestock. Rituals include prayers, ceremonial tables of fruits and grains, music, dance, and community gatherings. Transmission occurs through storytelling, participation, and educational institutions, promoting social cohesion.
Traditional Knowledge and Skills of Atlas and Adras Fabric Production	Silk and silk-cotton weaving tradition involving cocoon gathering, spinning, dyeing, and hand-weaving. Worn widely by women and girls, the fabrics are key markers of cultural identity. Knowledge is transmitted through families, production centers, schools, and festivals.
Sadeh/Sada Celebration	Winter festival marking 100 days before spring, featuring fire rituals, offerings, agricultural work, and community clean-ups. Transmission occurs through participation, storytelling, and media. The celebration promotes peaceful interaction and cultural continuity.
Art of Illumination (Zarhalkori)	Decorative art using gold leaf and pigments to embellish manuscripts, calligraphy, and documents. Taught through apprenticeships and formal education, it reinforces cultural continuity and supports the restoration of historical manuscripts.
Sericulture and Traditional Production of Silk for Weaving	Cultivation of silkworms and production of silk threads used for fabrics, carpets, and crafts. Rooted in Silk Road traditions, the practice symbolizes cultural identity and social cohesion, with knowledge passed through families and artisan workshops.
Telling Tradition of Molla Ependi Anecdotes	Oral and written storytelling tradition centered on humorous, wise anecdotes used to teach, persuade, and entertain. Widely shared across Central Asia, the tradition is transmitted through families, media, festivals, and educational institutions.
Falak	Traditional mountain folklore music expressing themes of love, pain, homeland, and longing. Performed a cappella or with instruments during ceremonies, rituals, and daily life. Transmission occurs within families and through formal music education.
Chakan, Embroidery Art in the Republic of Tajikistan	Embroidery tradition featuring floral and symbolic motifs on clothing and household items. Practiced mainly by women and girls, transmitted through families and the master-student method. Chakan garments play key roles in weddings and festivals.

Intangible Cultural Heritage	Summary
Oshi Palav, Traditional Meal and Its Social and Cultural Contexts	Iconic Tajik dish with many regional variations, prepared during daily meals, gatherings, and rituals. Cooking is a communal activity accompanied by music and socializing. Knowledge is passed through families and a master-apprentice system marked by ceremonial recognition.
Shashmaqom Music	Classical musical tradition blending vocal and instrumental performance, poetry, and complex modal structures. Rooted in centuries of Central Asian history, transmitted primarily through oral master-student training and formal conservatory education.

At present, available information does not permit a definitive determination regarding the presence of these intangible cultural heritage receptors within the communities along the proposed Project route. However, it is probable that festivals such as Navruz, Mehregan, and Sadeh/Sada—which are widely observed throughout Central Asia—are practiced by these communities. These celebrations may be vulnerable to project-related impacts should construction activities produce noise or dust disruptions, or if such activities impede stakeholders’ access to the courtyards or village squares used for Sada or Nowruz celebrations, where families gather for performances, games, and seasonal rites.

Temporary road closures and dust resulting from construction activities could adversely affect Sericulture and the Traditional Production of Silk for Weaving, if these practices are present in the region. Environmental harm to mulberry bushes, caused by dust or pollution, or restricted access due to construction works could impact silkworm cultivation practices. Temporary road closures could restrict stakeholder access to small-scale sericulture spots involved in traditional silk production, often found in rural homes or farm outbuildings.

Additionally, road operation may negatively influence intangible cultural heritage assets, such as Chakan traditional embroidery, Atlas and Adras fabric production, and the Art of Crafting and Playing Rubab (where practiced), by potentially enabling the introduction of less expensive global products and modern materials, which could undermine the production and use of traditional items. Conversely, operation of the road could have positive benefits on these traditional craft practices if it opens or facilitates access to new markets for traditional producers.

Additional stakeholder engagement with local stakeholders is necessary to determine if any of the 13 UNESCO listed intangible cultural heritage receptors and/or any other, locally distinct intangible cultural heritage receptors are practiced in the communities along the Project route.

6.3.9. Road Safety

National Road Safety Context

Tajikistan has a comparatively high road traffic fatality rate. According to the World Health Organization³⁴, the road traffic crash fatality rate stands at 13.9 deaths per 100,000 population — slightly above the Central and West Asia regional average of 13.1, and broadly comparable with the Asia-Pacific average of 15.2. This is markedly higher than the European average of 6.7 per 100,000³⁵. A particularly concerning feature of the Tajikistan casualty profile is the high proportion of pedestrian and cyclist fatalities, which account for approximately 42% of all road traffic deaths — significantly exceeding the Asia-Pacific average of 31%³⁶. This reflects the particular vulnerability of non-motorised

34 WHO (2021). Global Status Report on Road Safety 2021. World Health Organization, Geneva.

35 ATO (2025). Tajikistan Road Safety Profile 2025. Asian Transport Observatory. Available at: <https://asiantransportobservatory.org/analytical-outputs/roadsafetyprofiles/tajikistan-road-safety-profile-2025/> [Accessed March 2026].

36 John Aldridge Consultancy Ltd (2026). Baljuvon–Sari Khosor Road Project: Stage 2 Road Safety Audit (Reference: jma/26265/001, Revision 001). John Aldridge Consultancy Ltd, Petersfield.



road users, a pattern that is directly relevant to the project corridor given the prevalence of pedestrian activity in and around the villages along the route.

Data collection and reporting in Tajikistan remains limited and inconsistent, which constrains a full understanding of road safety performance at the national and subnational level (John Aldridge Consultancy, 2026). There is currently no evidence that Tajikistan has developed a comprehensive National Road Safety Strategy with explicit targets, specific measures, and allocated resources. The only documented progress in this direction is a draft paper prepared in April 2017, developed as part of the ADB-funded CAREC 'Safely Connected' regional road safety strategy (ADB, 2017), which sets a regional ambition of a 50% reduction in fatalities on CAREC corridors by 2030 against a 2010 baseline.

Several national policy documents — including the National Transport Development Programme up to 2025³⁷, the Medium-Term Development Programme, and the National Development Strategy up to 2030 — contain provisions that may indirectly benefit road safety. However, none of these constitutes a dedicated road safety strategy with quantified targets or funded implementation mechanisms (John Aldridge Consultancy, 2026).

Existing Road Conditions on the Project Corridor

The existing BSK road was originally constructed in the 1960s and has received no substantive improvement since³⁸. It does not meet the requirements of the Category V technical standard and fails to provide basic safety conditions for users.

The road surface is predominantly an unsealed earth and gravel track, passable in dry conditions only by four-wheel drive vehicles. The carriageway width varies between 4.0 and 5.0 metres along partially improved sections, narrowing further in places, against a Category V standard requirement of 6.0 metres of paved carriageway with 1.0-metre shoulders on each side. Minimum horizontal curve radii of less than 30 metres are recorded in several locations, and longitudinal gradients exceed 15% on some sections — both well outside design standard tolerances (PIURR, 2023). Sight distances are severely constrained by the mountainous terrain, with visibility limited to 50–100 metres on certain sections (PIURR, 2023).

Between approximately km 36 and km 54, there is effectively no engineered road surface at all; vehicles travel along the riverbeds of the Shurobdaryo on either bank, depending on water levels. Travel time from Baljuvon to Sari Khosor hotel — a distance of approximately 56 km — exceeds four hours under normal conditions (PIURR, 2023).

There is a complete absence of standard road safety infrastructure throughout the corridor. No side ditches, drainage channels, berms, shoulders, road signs, vehicle restraint systems, or road markings are present. In the settled sections, there are no footways, pedestrian facilities, lighting, or bus stops (PIURR, 2023). In the village of Toidara and other settlements along the route, residential buildings and fences are built directly to the road edge, with no separation between pedestrian activity and vehicle movements.

Seasonal hazards significantly compound existing safety conditions. Heavy snowfall renders the road impassable during winter months, and the road is subject to periodic closure due to mud flows, landslides, and rockfalls — all of which are documented hazards in the project area (PIURR, 2023; John Aldridge Consultancy, 2026). Flooding and the seasonal rise in the level of the Shurobdaryo also restrict access, particularly to the upper sections of the corridor.

³⁷ Government of Tajikistan (2011). Order No. 165: State Target Development Programme of the Transport Complex of the Republic of Tajikistan to 2025. Government of the Republic of Tajikistan, Dushanbe.
Government of Tajikistan (2016). National Development Strategy of the Republic of Tajikistan to 2030. Government of the Republic of Tajikistan, Dushanbe.

³⁸ Griese, C. (2026). Rehabilitation of the Baljuvon–Sari Khosor Highway: Final Report Explanatory Note. Road Rehabilitation Project Implementation Unit (RRPIU), Ministry of Transport, Republic of Tajikistan.

Traffic Volumes

Current traffic volumes on the existing road are very low, recorded at approximately 10–20 vehicles per day on the upper sections of the corridor, with slightly higher flows closer to Baljuvon (PIURR, 2023). Traffic growth has been observed at approximately 10% per annum, driven by increasing demand from the approximately 6,000 residents living along the road and an estimated 30,000 people in the broader Baljuvon district catchment (PIURR, 2023). The vehicle fleet is dominated by light four-wheel drive vehicles given the condition of the existing track, with some heavier freight vehicles on the lower sections.

Projected traffic flows following road rehabilitation are derived from the ADB IEE baseline of approximately 100 vpd corridor-average AADT and a two-phase growth model that reflects the trajectory expected for a newly paved mountain corridor. The first phase, covering approximately the first seven years after road opening, applies a growth rate of 20% per year to capture induced demand from substantially reduced journey times, year-round access, and the early-stage development of tourism to the Sari Khosor waterfall and Nature Park. From Year 8, growth moderates to approximately 9% per year as the initial induced-demand effect subsides and traffic settles into a longer-run trend driven by population growth, freight activity, and incremental tourism development. A long-run AADT ceiling of approximately 1,000–1,200 vpd is applied as a practical upper bound, consistent with the corridor catchment population, prevailing rural Khatlon vehicle ownership rates, and the Category V design standard. Projections are summarised in Table 54.

Table 54: Projected Traffic Flows on the BSK Corridor (AADT, vpd)

Period	AADT (vpd)	Notes
Current baseline (pre-rehabilitation)	~100 corridor average; 10–20 on upper sections	ADB IEE (2025); concentrated in lower corridor near Baljuvon
Year 1 (road opening)	~120	Includes initial induced demand from year-round access
Year 5	~250	Phase 1 — 20% per year growth
Year 7	~360	End of induced-demand phase
Year 10	~460	Phase 2 — 9% per year growth
Year 15	~710	Approaching catchment-driven long-run plateau
Year 20	~1,100	Long-run AADT ceiling reached

Source: ESIA team analysis based on ADB IEE (2025) baseline and the two-phase growth model set out in Section [Noise and Vibration].
AADT = Annual Average Daily Traffic.

The vehicle fleet is expected to shift away from the current dominance of light four-wheel drive vehicles towards a more conventional mix including light passenger cars, light commercial vehicles, and heavier freight vehicles, as the road condition no longer constrains vehicle access. The projected flows feed the operational impact assessments for noise (Section [Noise and Vibration]), air quality (Section [Air Quality]), and road safety (Section [Road Safety]).

7. Impact Assessment and Mitigation and Management Measures

7.1. Scoping

Prior to undertaking the impact assessment, a formal scoping exercise was conducted to identify the environmental and social issues requiring detailed or focused assessment and to screen out issues unlikely to result in significant impacts. The scoping process drew on the project description, preliminary baseline data, applicable EBRD ESRs, national regulatory requirements, and stakeholder inputs received during early consultations. The outcomes are summarised in Table 55 below. This table has determined the structure and scope of the impact assessment presented in the sections that follow.

Issues are classified as scoped in for detailed assessment (where impacts may be significant), scoped in for focused assessment (where impacts are expected to be limited but require confirmation), or scoped out (where available information indicates a low likelihood of significant impact).

Table 55: Scoping Table

Topic	Project Phase	Potential Risk / Impact	Stakeholder Input (from SEP records)	Scoping Decision	Rationale	EBRD ESR
Physical Environment						
Climate change and natural hazards	All phases	Flooding, landslides, mudflows, erosion, rockfall affecting road safety and resilience	Communities at March 2026 informal consultations specifically raised landslides, flooding, rockfalls, and mudflows as daily concerns affecting road use.	Scoped in – detailed assessment	Climate Hazard / Risk Assessment identifies widespread exposure to multiple hazards along the corridor, with numerous hazard-prone locations. These risks are material to road safety, reliability, and long-term resilience and require detailed ESIA assessment.	ESR1
Topography, geology and soils	Construction	Slope instability, erosion, spoil generation	No specific community input; confirmed through technical review.	Scoped in – detailed assessment	The road traverses steep and geomorphologically active terrain, requiring extensive cut-and-fill works and spoil management. Baseline conditions indicate high sensitivity to disturbance, warranting detailed assessment.	ESR1
Water resources and hydrology	Construction / Operation	Flooding, river erosion, drainage failure affecting road integrity and watercourses	Communities raised river flooding and road washouts at March 2026 consultations; natural spring near Chiltori flagged as requiring design consideration.	Scoped in – detailed assessment	The road alignment runs for extended sections adjacent to or within the active channel and floodplain of the Shurobdaryo. Baseline conditions indicate strong seasonal flows, high sediment and debris transport, active lateral erosion, and historic damage to road embankments, requiring detailed assessment.	ESR1
Air quality (construction)	Construction	Dust and emissions from earthworks and traffic	Dust impacts on agriculture and housing raised directly by residents at March 2026 consultations.	Scoped in – focused assessment	Construction activities will generate dust and emissions in close proximity to settlements and sensitive receptors. Impacts are expected to be temporary and manageable but require assessment to define controls.	ESR1
Air quality (operation)	Operation	Traffic emissions	No stakeholder concerns raised; scoped out on technical grounds.	Scoped out	Traffic volumes will remain well below levels associated with significant roadside air quality impacts. The corridor is open and well-ventilated with good dispersion conditions. Operational air quality impacts at settlement receptors are not expected to be	ESR1

Topic	Project Phase	Potential Risk / Impact	Stakeholder Input (from SEP records)	Scoping Decision	Rationale	EBRD ESR
					significant. Will be confirmed qualitatively in the impact assessment.	
Noise and vibration (construction)	Construction	Noise disturbance to nearby settlements	No specific noise concerns documented in SEP records; to be confirmed from consultation notes.	Scoped in – focused assessment	Settlements and noise-sensitive receptors are located close to the alignment. Construction noise will be temporary but potentially disruptive, requiring focused assessment and mitigation.	ESR4
Noise (operation)	Operation	Traffic noise	No specific stakeholder input.	Scoped in – screened assessment	Improved road condition is expected to increase traffic levels. Noise-sensitive receptors are present close to the road, and local geometry may influence noise propagation, requiring screening.	ESR4
Biological Environment						
Biodiversity – habitats	Construction / Operation	Disturbance to riparian and modified habitats	Protected Areas Authority confirmed ecological sensitivity of Sari Khosor Nature Park and need for careful consideration of indirect impacts (June 2023); Academy of Sciences experts identified sensitive species and habitats (March 2026).	Scoped in – focused assessment	While much of the corridor is modified, riparian habitats with higher ecological sensitivity are present. Focused assessment is required to confirm sensitivity and mitigation needs.	ESR6
Biodiversity – fauna	Construction / Operation	Disturbance to wildlife movement and sensitive species	Protected Areas Authority and Ministry of Transport both flagged proximity to Sari Khosor Nature Park as a key consideration (June 2023).	Scoped in – focused assessment	Fauna are expected to be largely common and disturbance-tolerant; however, river corridors may provide movement routes, and proximity to Sari Khosor Nature Park warrants confirmation.	ESR6
Protected areas	Operation (indirect)	Indirect effects on Sari Khosor Nature Park	No direct community concerns raised; Protected Areas Authority confirmed	Scoped in – focused assessment	The Project does not intersect the Nature Park, but improved access could lead to indirect or cumulative effects requiring focused consideration.	ESR6

Topic	Project Phase	Potential Risk / Impact	Stakeholder Input (from SEP records)	Scoping Decision	Rationale	EBRD ESR
			sensitivity; scoped in on precautionary basis.			
Aquatic ecosystems	Construction	Sedimentation, water quality impacts on river and tributaries	No direct community input; expert consultations identified aquatic sensitivity.	Scoped in – focused assessment	In-stream works and drainage upgrades may affect sediment loads and water quality during construction, necessitating focused assessment.	ESR6
Socio-economic Environment						
Land acquisition and land use	Construction	Permanent and temporary land take	Land impacts and compensation methodology raised at multiple public consultations (August–September 2023); emphasis on minimising impacts on agricultural land and businesses.	Scoped in – detailed assessment	The RP confirms partial acquisition of agricultural, dehkan, and forestry land, loss of ancillary structures, trees, and crops. These impacts constitute economic displacement under ESR5 and require detailed assessment.	ESR5
Livelihoods	Construction / Operation	Impacts on agriculture, grazing, forestry and tree crops	Household survey (March 2026) confirmed strong reliance on land-based agriculture and seasonal income; majority reported seasonal isolation affecting market access.	Scoped in – detailed assessment	Livelihoods are predominantly land-based, with high dependence on dehkan farming, livestock grazing, forestry land use, and tree crops. The RP identifies livelihood impacts including cases of severe impact, warranting detailed assessment and livelihood restoration planning under ESR5.	ESR5
Vulnerable groups	All phases	Disproportionate impacts on vulnerable households	Household survey identified demographics including female-headed and elderly-headed households and households with disabled members.	Scoped in – focused assessment	The RP and socio-economic baseline identify vulnerable households. Given high dependence on land-based livelihoods, these groups may experience disproportionate impacts from even partial land loss, requiring focused assessment and differentiated mitigation.	ESR5, ESR10

Topic	Project Phase	Potential Risk / Impact	Stakeholder Input (from SEP records)	Scoping Decision	Rationale	EBRD ESR
Community health and safety	Construction / Operation	Traffic safety, access disruption, construction hazards	Road safety for pedestrians and livestock raised at August 2023 Baljuvon consultation and March 2026 informal consultations; protection of irrigation channels raised.	Scoped in – detailed assessment	The road passes through and close to settlements, with known baseline safety concerns. Construction and operation both present material community safety risks.	ESR4
Road safety	Construction / Operation	Risks to pedestrians, cyclists and vulnerable road users	Road safety was one of the most consistently raised community concerns across all consultations in 2023 and 2026.	Scoped in – detailed assessment	High proportion of pedestrian activity at roadside, children and livestock present in settlement areas. Road safety is a key project benefit but construction phase presents elevated risk.	ESR4
Labour and working conditions	Construction	Worker rights, recruitment, accommodation, conditions of employment, grievance access, freedom of association	Local employment during construction raised as a primary recommendation at March 2026 consultations.	Scoped in – focused assessment	Contractor workforce and potential labour influx introduce labour rights and HR risks that require focused assessment, including non-discrimination, fair recruitment, decent accommodation, and worker grievance access.	ESR2
Occupational Health and Safety	Construction	Worker safety risks from heavy plant operation, working at height (bridge and slope works), in-river works, slope instability, rockfall, extreme heat and cold exposure, and potential asbestos in demolition of legacy culverts and structures	Local employment during construction raised at March 2026 consultations; no specific OHS concerns documented at scoping stage.	Scoped in – detailed assessment	The corridor's mountainous setting, active geohazard environment, in-river works programme, climate exposure (extreme summer heat and winter cold), and Soviet-era infrastructure with potential asbestos in legacy culverts and structures elevate occupational risk. ESR2 OHS requirements warrant detailed assessment.	ESR2

Topic	Project Phase	Potential Risk / Impact	Stakeholder Input (from SEP records)	Scoping Decision	Rationale	EBRD ESR
GBV / SEA-SH	Construction	Gender-based violence and sexual exploitation and harassment risks from labour influx	Not explicitly documented in SEP records at scoping stage; specific engagement with women and girls to be conducted during ESIA disclosure consultations.	Scoped in – focused assessment	Large non-local workforce in remote rural setting triggers EBRD requirements for SEA/SH risk screening and management. Dedicated SEA/SH Action Plan required as part of the ESMP.	ESR2, ESR4, ESR10
Cultural heritage – cemeteries	Construction	Disturbance to burial sites	No specific community input documented in SEP at scoping stage; to be confirmed from consultation notes.	Scoped in – focused assessment	Known cemeteries are located close to the alignment. These are culturally sensitive assets requiring avoidance and focused assessment.	ESR8
Cultural heritage – museum	Construction / Operation	Impacts on setting of Baljuvon Fortress Museum	No concerns raised.	Scoped out	The museum is located near the start of the road but outside the construction footprint. No physical or setting impacts are anticipated.	ESR8
Archaeology / chance finds	Construction	Discovery of subsurface heritage during earthworks	No community input; scoped in on technical grounds.	Scoped in – focused assessment	Long-established settlement history and planned earthworks across the full 56 km corridor indicate potential for chance finds, requiring a Chance Find Procedure embedded in the ESMP.	ESR8
Traffic and transport	Construction / Operation	Temporary disruption; improved access in operation	Access disruption, travel times, and seasonal isolation raised consistently across all community consultations in 2023 and 2026.	Scoped in – focused assessment	Construction will affect traffic and access for communities along the corridor, while operation delivers key connectivity benefits. Traffic management measures required during construction.	ESR4
Waste management	Construction	Construction and hazardous waste generation	Protection of water sources and irrigation channels raised (March 2026); no specific waste concerns documented.	Scoped in – focused assessment	Road construction will generate waste streams including excavated material, pavement waste, hazardous materials, and domestic waste. These are standard and well understood but require management.	ESR1, ESR3

Topic	Project Phase	Potential Risk / Impact	Stakeholder Input (from SEP records)	Scoping Decision	Rationale	EBRD ESR
Cumulative impacts	All phases	Combined effects with other activities; induced development	Tourism development potential raised at Sari Khosor Hotel (May 2023) and confirmed in household survey.	Scoped in – qualitative assessment	Improved access may contribute to tourism growth, agricultural intensification, and other land use changes in the Project area and Sari Khosor, warranting qualitative cumulative assessment.	ESR1
Indigenous Peoples	All phases	—	Not applicable.	Scoped out	No Indigenous Peoples as defined under EBRD ESR7 are present within the Project area of influence. All affected communities are settled rural Tajik communities integrated into the national governance framework.	ESR7

7.2. Impacts and Mitigation

This section presents the assessment of key environmental and social risks and impacts associated with the construction and operation of the BSK Project. The assessment draws on the environmental and social baseline described in Section 6, the project description in Section 2, and the impact identification and scoping exercise set out in the Scoping Report (2026) and summarized above.

The assessment is organised by topic, following the structure of the scoping table in Section 7.1, and covers the physical environment, biological environment, and socio-economic environment. For each topic, the assessment describes the project activities with the potential to cause impact, the sensitive receptors, the nature and significance of potential impacts before mitigation, the proposed mitigation and management measures, and the residual significance following mitigation. Impact significance is assessed using a consistent multi-criteria methodology described in Section 5 which considers the magnitude, spatial scale, timeframe, and probability of each impact alongside the sensitivity of the receiving environment (note, some subsections, such as cultural heritage follow a separate impact methodology as described in the specific sub-section). All mitigation measures identified in this section, together with the associated monitoring requirements, are carried forward in full into the ESMP.

7.3. Air Quality

7.3.1. Project Activities with Potential to Emit Atmospheric Pollutants and Greenhouse Gases

Engines and processes that combust fuels have the potential to emit atmospheric pollutants including nitrogen oxides (NO_x), sulphur dioxide (SO₂), carbon monoxide (CO), and particulate matter (PM), along with greenhouse gas carbon dioxide (CO₂) and volatile organic compounds (VOCs).

The following construction activities involve fuel combustion:

- Operation of diesel-powered vehicles at construction work fronts, borrow pits, quarries, and construction camps.
- Operation of an asphalt plant for production of wearing course material.
- Operation of crushers and screening plants for aggregate production.
- Operation of diesel-powered construction plant (excavators, graders, rollers, compactors) throughout the corridor.
- Operation of diesel power generators at construction camps.

The following planned project activities have the potential to generate nuisance dust and fugitive particulate emissions:

- Bulk earthworks including cut and fill, embankment construction, and slope re-profiling.
- Excavation of borrow pits and quarries, and loading of aggregate and fill material.
- Vehicle movements on unpaved haul roads and access tracks along the 56 km corridor.
- Loading, unloading, and stockpiling of fine materials (soil, aggregate, sand, crusher dust, cement).
- Concrete batching and cement handling.
- Blasting in rock cut sections, where required.
- Demolition of existing structures.



7.3.2. Sensitive Receptors

The BSK corridor passes through a narrow mountain valley with 19 settlements distributed along the 56 km alignment. The confined valley topography means that many settlements are located immediately adjacent to the road, with limited separation distance. Residents in these settlements are the primary sensitive receptors for construction dust and air emissions.

In addition to residential communities, several schools and health clinics are present along the corridor. These are considered sensitive receptors of elevated concern given the vulnerability of the populations they serve (children, patients) and the potential for prolonged exposure during school and working hours.

Agricultural land borders significant portions of the alignment. Dust deposition on crops and irrigation water can affect agricultural productivity, representing an additional sensitive receptor category.

Construction workers at active work fronts, particularly those operating plant at the asphalt plant, crusher, and in bulk excavation areas, are also sensitive receptors in the occupational context.

Baseline air quality in the corridor is generally good, reflecting the rural setting and absence of major industrial emission sources. However, dust generated by traffic on the existing unpaved road surface represents a persistent and locally significant issue during dry weather. Community sensitivity to construction dust impacts is therefore likely to be elevated given this pre-existing nuisance.

7.3.3. Potential Impacts

Construction Phase

Dust from Earthworks and Unpaved Haul Roads — Dust generation is the principal air quality concern for this project. The combination of bulk earthworks, aggregate extraction at borrow pits and quarries, and sustained heavy vehicle movements on unpaved haul roads will generate significant quantities of fugitive particulate matter (PM₁₀ and PM_{2.5}) during the dry construction season.

The hot, dry summer months (approximately June to September) present the highest risk, when rainfall is minimal, soils are desiccated, and wind speeds are sufficient to disperse dust plumes. Construction activities in this period near the 19 settlements will have the potential to cause dust nuisance and, if uncontrolled, health impacts at nearby sensitive receptors.

Dust from earthworks typically comprises larger-diameter particles that settle relatively close to the source. However, PM_{2.5} fractions generated by vehicle movements on unpaved surfaces can remain airborne over greater distances. Settlements within 200 m of active work fronts or unpaved haul routes are at elevated risk of impact during high-dust activities.

The magnitude of dust impacts will depend on wind speed and direction at the time of works, the duration and scale of earthworks at each location, and the effectiveness of dust suppression measures.

Asphalt Plant Emissions — The asphalt plant is the most significant point source of air emissions on the project. The drum dryer burner will generate combustion products including NO_x, SO₂, CO, and PM. Bitumen storage, heating, and mixing will produce volatile organic compound (VOC) and polycyclic aromatic hydrocarbon (PAH) emissions. These compounds can cause health impacts at nearby sensitive receptors if plant siting and emission controls are inadequate.

The specific location of the asphalt plant will be confirmed by the Contractor post-award. The siting must account for prevailing wind direction relative to settlements and must maintain a minimum separation distance of 500 m from the nearest settlement. All required national air emission permits under the Law on Atmospheric Air Protection (2011) must be obtained before commissioning.

Crusher and Screening Plant Dust — Operation of crushers and screening plants for aggregate production will generate significant dust at feed, discharge, and conveyor transfer points. The particle



size distribution from crushing operations includes a significant fine fraction (PM_{10} and $PM_{2.5}$) that can be carried downwind toward sensitive receptors. As with the asphalt plant, minimum separation distances from settlements (500 m) and operational dust suppression controls will be required.

Vehicle and Construction Plant Exhaust Emissions — Combustion of diesel fuel by the construction vehicle fleet will generate NO_x , CO, and PM exhaust emissions across the full length of the 56 km corridor. These emissions are dispersed and temporary, and are not anticipated to generate concentrations of atmospheric pollutants at levels exceeding applicable standards given the open, well-ventilated valley setting. Poorly maintained engines producing visible black smoke will however represent a localized nuisance and health concern and must be addressed through a preventative maintenance programme.

Operational Phase

The project involves rehabilitation of the existing road rather than construction of a new route. No material increase in traffic volumes is anticipated as a direct consequence of the works in the short term. The paving of previously unpaved road sections will remove the persistent road-surface dust that currently affects settlements along the corridor. Operational phase air quality impacts are therefore expected to be positive on balance, with a reduction in the existing dust nuisance. No further operational air quality assessment is required.

Cumulative Impacts

No significant cumulative air quality impacts have been identified. There are no other major construction projects or industrial sources proposed in proximity to the corridor that would interact with project construction emissions.

Transboundary Impacts

All construction activities are located within Tajikistan. No transboundary air quality impacts are anticipated.



7.3.4. Impact Summary and Assessment of Significance

Table X provides an assessment of the significance of potential air quality impacts before implementation of the proposed mitigation measures. Impact significance is assessed based on the magnitude of the potential impact, the sensitivity of receptors, the spatial scale, timeframe, and probability of the impact occurring.

Table 56: Impacts and Significance – Air Quality

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	Dust (PM ₁₀ /PM _{2.5}) from earthworks, borrow pits and unpaved haul roads	Communities in up to 19 settlements along 56 km corridor; workers; agricultural land	M	M	H	M	MAJ	ST	INT	M	DEF	M
C	Asphalt plant emissions (NO _x , SO ₂ , CO, PM; bitumen VOC/PAH)	Nearest settlement to plant; plant workers	M	M	M	M	MOD	ST	SMA	M	DEF	M
C	Crusher and screening plant dust (PM ₁₀ /PM _{2.5})	Nearest settlement to crusher; workers at plant	M	M	M	M	MOD	ST	SMA	M	DEF	M
C	Vehicle and construction plant exhaust emissions (NO _x , CO, PM from diesel)	Communities along alignment; workers at active work fronts	M	M	L	L	MOD	ST	SMA	L	DEF	L
O	Operational traffic dust and emissions	Communities in up to 19 settlements along 56 km corridor, agricultural land	M	M	L	-	MOD	LT	SMA	M	UN	M+



Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minor / LT: Long term / MT: Medium Term / ST: Short term / SMA: Small / INT: Intermediate / EXT: Extensive / DEF: Definitely / POSS: Possible / UNLIKE: Unlikely. Phase: C = Construction; O = Operation. + = positive impact



7.3.5. Mitigation and Management Measures

Pre-Construction Phase

Air Quality and Dust Management Planning — The Contractor shall, as part of the CESMP, prepare and implement an Air Quality and Dust Management Plan (AQDMP) in accordance with the Framework provided in Annex 13 of the Project ESMP. The AQDMP shall be completed with site-specific details including asphalt plant and crusher locations, monitoring station locations, and haul route dust management arrangements before earthworks or plant commissioning commence. The Plan shall be submitted to the Engineer for approval.

Permitting — All required national air emission permits under the Law on Atmospheric Air Protection (2011) shall be obtained by the Contractor before commissioning of the asphalt plant, crusher, or any other stationary emission source. Permit copies shall be maintained on site and made available for inspection. No emission source shall become operational without the required permits.

Siting of Facilities — The locations of the asphalt plant, crusher and screening plant, construction camps, borrow pits and quarries, and spoil disposal sites shall be subject to approval by the Engineer and relevant national authorities. The asphalt plant and crusher shall be sited a minimum of 500 m from the nearest settlement boundary. Borrow pits, quarries, and spoil disposal sites shall comply with the siting constraints set out in ESMP Annex 6 Section 4.2 and BMP Annex 8 Section 5.3, including the 500 m settlement setback for spoil sites and the watercourse setbacks applicable to all facility types. All siting shall account for the prevailing wind direction, with facilities positioned downwind of the nearest settlement wherever site logistics permit.

Pre-Construction Baseline Monitoring — The Contractor's ESHS Manager shall establish baseline air quality at up to four representative settlement locations nearest to the proposed asphalt plant, crusher, the busiest haul route sections, and any borrow pit or spoil disposal site located within 500 m of a settlement. Baseline data shall inform the interpretation of construction-phase monitoring results.

Construction Phase

Dust — General Controls

- Water spraying of all active earthwork areas, exposed surfaces, borrow pit faces, and unpaved access and haul roads shall be implemented as a minimum twice per day during dry weather, and more frequently during hot (>25°C), dry, or windy (wind speed exceeding 20 km/h) conditions. Watering shall not be excessive as to cause muddy conditions.
- Speed limits for all construction vehicles on unpaved roads: not more than 20 km/h within 200 m of any settlement boundary; not more than 30 km/h elsewhere on unpaved haul routes. Speed limits shall be physically enforced with signage and, where necessary, speed humps.
- All vehicles transporting fine or loose materials (soil, aggregate, sand, crusher dust, cement) shall be covered with tarpaulins before leaving any work area or plant site onto haul routes or public roads.
- Wheel wash facilities shall be operational at all exits from borrow pits, quarries, crushers, spoil sites, and the asphalt plant. Construction vehicles shall not leave these sites with material adhering to tyres or bodywork.
- Stockpiles of fine material shall be protected from wind erosion using water spraying, windbreak screens, or covers. Stockpiles remaining in place for more than two weeks shall be seeded with a temporary cover crop or covered with hessian.



- The extent of simultaneously exposed bare soil shall be minimised. Completed earthwork sections shall be progressively stabilised by compaction, seeding, or covering as soon as practicable. Open burning of any material on site is absolutely prohibited.
- Mud and material deposited on public paved roads by construction vehicles shall be cleaned within 2 hours of identification. The Contractor shall maintain a record of mud complaints and cleaning actions.
- Where haul routes pass through or immediately adjacent to settlements, the Contractor shall consider application of chemical dust suppressants (e.g. calcium chloride or equivalent) on the haul route surface where water spraying alone is demonstrably insufficient to prevent dust reaching the settlement. Use of any chemical suppressant shall be approved by the Engineer and shall not be applied within 50 m of any watercourse.

Dust — Enhanced Controls Near Settlements

- Where active works are within 200 m of a settlement, school, clinic, or other sensitive receptor, dust suppression frequency shall be increased to at least three applications per day, with additional applications when wind is blowing directly toward the settlement.
- High-dust activities (bulk excavation, topsoil stripping, material crushing) shall be suspended when sustained wind speed exceeds 5m/s in the direction of a settlement and dust suppression is demonstrably insufficient to prevent dust reaching the settlement.
- The SCLO shall notify affected settlements at least 48 hours before high-dust activities commence in their vicinity, describing what works are planned and what controls will be in place.
- Community complaints about dust shall be recorded in the Grievance Register and responded to within 24 hours, with corrective action implemented immediately where the complaint is substantiated.

Asphalt Plant Emission Controls

- The asphalt drum dryer burner shall be properly calibrated and maintained to minimise incomplete combustion. Stack emissions shall comply with Tajik national Maximum Allowable Emission (MAE) standards or IFC/WHO EHS Guidelines, whichever is more stringent.
- Bitumen storage and handling shall employ closed systems wherever feasible to minimise fugitive VOC and PAH emissions. Hot bitumen shall not be left in open containers.
- Aggregate feed and transfer points on the plant shall be fitted with dust suppression (water sprays or enclosed transfer systems).
- Plant operators shall be trained in emission minimisation procedures including correct burner operation, maintenance schedules, and emergency shutdown procedures.

Crusher and Screening Plant Controls

- Crushing and screening operations shall be fitted with water spray suppression at all feed points, discharge points, and conveyor transfer points.
- Where enclosed crusher units are available, these shall be used in preference to open units.
- Wind screens or bund walls shall be erected on the downwind side of crushing areas where settlements are within 1,000 m.
- Workers at the asphalt plant, crusher and screening plant, and those engaged in bulk earthworks generating significant dust shall be issued with appropriate respiratory PPE (minimum N95 standard or equivalent). Use shall be enforced by site supervisors, particularly



during high-dust activities and when working within 10 m of a dust-generating source. PPE issuance and inspection records shall be maintained by the ESHS Manager.

Vehicle and Equipment Exhaust Emissions

- All diesel-powered construction vehicles, plant, and generators shall be maintained in accordance with manufacturer specifications. Maintenance records shall be kept and made available to the Engineer on request.
- Engines producing visible black smoke shall be taken immediately out of service until repaired and re-assessed. The Contractor shall maintain a record of all black smoke incidents and corrective actions.
- Vehicles and plant shall not be left idling unnecessarily. Engines shall be switched off when not in active use for more than five minutes.
- Generators shall be positioned away from accommodation areas and fitted with appropriate exhaust systems.

7.3.6. Residual Impacts

The following table provides an assessment of residual air quality impacts following implementation of the mitigation measures described above.

Table 57: Residual Impacts – Air Quality

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
C	Dust (PM ₁₀ /PM _{2.5})	Medium	Residual dust impacts will be localised to the immediate works area and temporary in duration. Diligent implementation of the AQDMP is required to maintain compliance at settlement boundaries; the risk is manageable but not self-executing.	Not Significant
C	Asphalt plant & crusher emissions	Medium	No material residual impact on settlement air quality provided siting distances and permit conditions are observed.	Not Significant
C	Vehicle & plant exhaust	Low	No material residual impact with a standard maintenance regime in place.	Not Significant
O	Operational traffic dust and emissions	Medium	Road paving removes the primary source of dust currently affecting corridor settlements. Operational air quality will improve relative to baseline.	Not Significant (positive)

7.3.7. Monitoring

Monitoring of air quality impacts shall be undertaken per the Project ESMP monitoring programme. Requirements are summarised in Table 58 below.

Table 58: Monitoring – Air Quality

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Equipment
Construction Phase					
Visual dust inspection	Opacity and plume observations; wind direction and speed	Daily at all active work fronts	Active work fronts and boundary of nearest settlement to active works	Contractor Environmental Inspector	Direct observation; recorded in daily site diary. No equipment cost.
Instrumental PM monitoring	PM ₁₀ (24-hr average); WHO guideline 45 µg/m ³ or Tajik MAC (lower applies)	Monthly during active earthworks; triggered by dust complaints or high-risk conditions	Nearest settlement to active high-dust works; schools and clinics within 250 m of works	Contractor (ESHS Manager); Engineer verification	Portable real-time optical dust meter or gravimetric sampler. Report within 24 hours of any exceedance.
Instrumental PM monitoring	PM _{2.5} (24-hr average); WHO guideline 25 µg/m ³ or Tajik MAC (lower applies)	Monthly during asphalt plant and crusher operation	Nearest settlement to asphalt plant; nearest settlement to crusher	Contractor (ESHS Manager); Engineer verification	Portable real-time PM monitor or gravimetric sampler.
Depositional dust gauge	Total deposition (mg/m ² /day); GIIP benchmark 350 mg/m ² /day	Monthly composite samples	Up to 4 locations at boundaries of settlements nearest to active works; positions confirmed by ESHS Manager post-award	Contractor (ESHS Manager)	Standard deposit gauge (Bergerhoff or equivalent). Monthly collection and lab analysis.
Exhaust emission / smoke check	Visible black smoke from operating plant and vehicles	Daily during all construction phases	All operating plant and vehicles at work fronts, asphalt plant, and haul routes	Environmental Inspector; Site Supervisors	Visual observation. Engines producing visible black smoke removed from service immediately.
Asphalt plant stack monitoring	NO _x , SO ₂ , CO, PM (stack); national Tajik MPE limits and IFC EHS Guidelines	Per permit conditions; minimum quarterly during operation	Asphalt plant stack	Contractor Plant Manager; independent lab if required by permit	Stack sampling per GOST methodology or equivalent. Results reported to Engineer.
Community complaints log	Number and nature of dust/air quality complaints	Continuous; reviewed weekly	All settlements along corridor	SCLO; ESHS Manager	Grievance Register. Complaints about air quality to be responded to within 24 hours with corrective action where substantiated.

7.4. Natural Hazards

The natural hazard environment of the BSK corridor is the defining characteristic of the project setting. Unlike impact topics where the project is the primary source of risk to the receiving environment, natural hazards present a relationship that runs in both directions: the hazard environment poses direct risks to the project, its workers, and the communities and road users who depend on it, while the construction process itself — particularly earthworks, river crossings, and slope cutting — can temporarily increase the exposure of workers and nearby communities to hazard consequences. This section assesses impacts in both directions and across both phases.

7.4.1. Project Activities with Potential to be affected by natural hazards

The BSK corridor runs for 56 km through a narrow mountain valley carved by the Shurobdaryo. The valley is geomorphologically active, seismically exposed, and subject to a concentrated seasonal hydrological regime driven by snowmelt and spring rainfall. The key hazard types relevant to the project are:

- Flooding and debris flows from the Shurobdaryo and its tributary catchments, including flash flood events on dry tributary channels.
- Landslides and mudflows from steep, weathered slopes above the alignment, particularly during and immediately after intense or prolonged rainfall.
- Rockfall from unstable rock faces above and adjacent to the road.
- Seismic events, reflecting the corridor's location within a tectonically active mountain region.
- Climate change, which acts as a cross-cutting amplifier of all the above hazards over both the construction period and the operational design life.

The project involves the following activities with direct relevance to natural hazard exposure:

- Earthworks, cut slopes, and embankment construction along the full corridor — destabilising slopes and creating temporary exposure of workers and plant to slope failure and rockfall.
- Bridge construction, river crossing works, and embankment protection works in the active floodplain and channel of the Shurobdaryo — exposing workers and partly-built structures to flood and debris flow events.
- Culvert construction and drainage improvement works — temporarily interrupting natural drainage and increasing the risk of localised ponding and overtopping during construction.
- Operation of construction camps and storage of plant, fuel, and materials — creating concentrations of people and assets in the hazard-exposed corridor.

7.4.2. Sensitive Receptors

Natural hazard impacts do not follow the conventional pollutant-receptor model used for air quality or noise. The receptors here are people, infrastructure, and assets in the path of hazard events. The key sensitive receptors are:

Construction Workers — Workers at active construction fronts in the floodplain, on river crossings, below cut slopes, and at bridge structure sites are the most acutely exposed receptors during the construction phase. A significant flood or landslide event during active works has the potential for serious injury or fatality.

Partly-Built Structures — Bridges, embankments, culverts, and retaining structures under construction are inherently more vulnerable to flood, seismic, and slope failure events than completed structures designed and built to full specification. Damage to partly-built structures can have cascading consequences for programme, cost, and structural integrity.



Communities Along the Corridor — Approximately 19 settlements are distributed along the alignment. Many are located in valley-bottom positions directly exposed to flood and debris flow hazard. The road also serves as the primary access route for these communities to services, healthcare, and markets; any road closure caused by a hazard event — whether during construction or operation — directly affects community welfare and, in an emergency, can be life-threatening.

Road Users — During operation, road users are exposed to the consequences of hazard events including flooding, rockfall onto the carriageway, landslide blockage, and bridge failure.

Road Infrastructure — The final constructed road itself, its embankments, bridges, culverts, and slope protection works, is a long-lived asset that will be exposed to the full range of natural hazards throughout its operational design life.

7.4.3. Potential Impacts

Construction Phase

Flooding and Debris Flows - Over extended sections of the corridor, the alignment runs directly adjacent to or within the active channel and floodplain of the Shurobdaryo. Recent hydrological assessments confirm that flood depths along certain sections can reach approximately 150 cm between km 0–5, and up to 263 cm between km 10–16 during 100-year return period events. Peak discharge in extreme events has been estimated at approximately 653 m³/s, with localised flow velocities potentially exceeding 7 m/s in constricted sections. Construction works at river crossings, embankment protection, and culvert installation will necessarily take place within or immediately adjacent to the active floodplain.

Workers at these locations during the flood season (approximately April to June, coinciding with peak snowmelt and spring rainfall) face direct risk of inundation of work areas, loss of plant and materials, and — in severe or rapidly developing events — risk to life. Tributary catchments along the corridor can generate flash flood events with very short warning times, potentially catching workers in low-lying positions with no opportunity to evacuate.

The risk is further elevated by the debris-laden nature of flood flows in this system. High-energy flows carrying rock, timber, and sediment can rapidly overtop or destroy temporary protective works such as cofferdams and diversion channels that might otherwise contain a clear-water flood event of similar magnitude.

Landslides, Mudflows and Rockfall - The corridor has been identified as having nearly 100 documented landslide, debris flow, and rockfall hazard locations. Steep gradients, shallow weathered soils, and the geological character of the valley slopes create conditions of inherent instability. This instability is periodic at baseline, but is significantly elevated immediately after intense or prolonged rainfall, rapid snowmelt, and seismic events.

Construction activity exacerbates natural slope instability in two ways. First, road widening and cut slope creation directly undercut existing slope material, removing natural support and creating new exposed faces that are vulnerable to failure during the period before protection measures are installed. Second, concentrated surface runoff from poorly-graded earthworks can trigger failures on slopes that were previously stable. Workers and plant operating below active cut faces, and communities in the valley below unstable slopes, are the primary receptors.

Rockfall is a near-continuous background risk along sections of the corridor adjacent to steep rock faces. Construction blasting and earthworks vibration can dislodge material from these faces, generating rockfall events larger and more frequent than the natural baseline.

Seismic Events - The BSK corridor lies within a seismically active mountain region. A significant seismic event during the construction period has the potential to cause collapse of partly-built bridge structures or retaining walls; destabilise cut slopes and trigger rockfall and landslide events



simultaneously along multiple sections of the corridor; and generate emergency conditions at construction camps. The structural vulnerability of partly-built infrastructure is higher than that of completed and designed structures, as interim conditions may not have been formally assessed for seismic loading.

Climate Change - Climate projections for the region indicate average temperature increases exceeding 4°C by mid-century, with maximum daily temperatures potentially exceeding 50°C. Extreme precipitation events are projected to intensify significantly under both intermediate and high-emission scenarios. These projections are directly relevant to the construction period because they imply that the frequency and magnitude of flood events, slope failures, and debris flows during the construction window may already exceed historical patterns used in hazard planning.

The construction period of approximately 36 months falls within the window of accelerating climate change. Contractors and the Engineer must therefore treat the historical hazard record as a minimum baseline rather than a reliable predictor of conditions during works.

Operational Phase

Flooding, Landslides, and Debris Flows - The operational design life of the rehabilitated road is 20–25 years. Over this period, the infrastructure will be exposed to the full range of natural hazards described above, under a climate trajectory of intensifying extremes. The consequences of a significant flood or landslide event during the operational phase include damage to or loss of embankment protection works, bridge scour and potential structural failure, culvert blockage by debris leading to overtopping and embankment washout, and road surface erosion and closure.

The current baseline demonstrates the consequences of inadequate hazard resilience: the existing road has experienced repeated damage from floods, slope failures, and debris flows, resulting in periodic isolation of communities along the corridor. The rehabilitation works are designed to materially improve hazard resilience, but the residual risk cannot be reduced to zero given the extreme character of the natural environment.

A point requiring clarification in the context of this assessment is the relationship between the rainfall input used in the design and the regional climate model figures that have been cited elsewhere for this region. The hydraulic design is based on an observed 100-year daily rainfall depth of 83 mm, derived from physical meteorological station records at Khovaling and Kangurt — the only station-based observed figure available for this location. Regional climate model outputs from UNDP and ADB assessments cite values of 132–177 mm for this region; however, these are not station records but outputs of statistical interpolation and climate modelling procedures applied across broad geographic areas. In complex mountain terrain where rainfall is highly localised and varies substantially over short distances, regional modelled estimates carry significant uncertainty at the specific project location. In the hierarchy of evidence, observed station data is the more reliable local estimate; the discrepancy with modelled figures reflects local variability and model uncertainty in data-sparse mountain terrain, and does not constitute evidence that the station-derived figure is a systematic underestimate.

The conservatism embedded in the design should be understood at two levels. First, SNiP 2.05.03-84 requires structures on a Category V road to be designed to 50-year and 33-year flood return periods for bridges and culverts respectively. The design uses a 100-year rainfall figure as the starting point and scales down to the required design standards — the 100-year observed rainfall is embedded from the outset, building in conservatism above the mandatory design standard across all drainage structures. Second, the conversion from rainfall to design flow involves two sequential amplification steps, each of which further insulates the final design flows from uncertainty in the rainfall input. The rainfall depth is converted to peak liquid discharge through a non-linear runoff formula — meaning that even a substantial increase in the rainfall figure produces a proportionally smaller increase in calculated flow. The liquid flow is then multiplied by a debris flow coefficient reflecting the volume of sediment, rock, and organic material carried by flows in these steep, erosion-prone catchments; these



coefficients range from 2.6 to 4.8 across the project, with most catchments above 3.5, and are determined by catchment physical characteristics rather than by the rainfall input. To illustrate: at Doshmandi (PK 188+50), a liquid flow of 8.61 m³/s becomes a design flow of 35.8 m³/s after applying a coefficient of 4.16; at Pasivaram (PK 238+00), a liquid flow of 30.7 m³/s becomes 127 m³/s at a coefficient of 4.14. Because the debris flow multiplier is independent of the rainfall input, even an increase to the highest cited modelled rainfall value would produce a proportionally far smaller change in the final design flows than the multiplier itself already applies. The design has substantial headroom to absorb both rainfall input uncertainty and realistic climate change uplifts within the range relevant to this project.

Operational Phase — Seismic Events

All bridges and retaining structures have been designed to applicable seismic load standards. A significant seismic event during the operational period has the potential to damage or destroy bridge structures and to trigger co-seismic landslides along sections of the corridor. Post-seismic inspection protocols and defined criteria for road re-opening are an essential component of the operational maintenance regime.

Cumulative Impacts

Natural hazard impacts are inherently cumulative in this setting: a single extreme event commonly triggers multiple simultaneous hazard processes — a major flood is accompanied by debris flows, landslides, and bridge scour occurring at multiple locations along the corridor simultaneously. The combined effect can be road closure along extended sections rather than isolated point closures. The design and operational maintenance regime must be capable of responding to multi-hazard scenarios of this kind.

Transboundary Impacts

The Shurobdaryo system drains to the Kyzylsu and ultimately to the Panj River, which forms the border with Afghanistan. Significant construction-phase erosion or sediment discharge events could in principle contribute to downstream sediment loads. This risk is addressed under the Water Resources section. No direct transboundary natural hazard impacts from the project itself are anticipated.



7.4.4. Impact Summary and Assessment of Significance

Table 59 provides an assessment of the significance of potential natural hazard impacts before implementation of the proposed mitigation measures. Given the character of this topic — where impacts arise from the hazard environment acting on the project rather than purely from the project acting on the environment — significance ratings reflect the combined effect of the inherent hazard severity, the exposure of receptors, and the probability of a damaging event occurring.

Table 59: Impacts and Significance – Natural Hazards

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
Construction Phase												
C	Flooding and debris flows affecting workers and construction plant at riverside work fronts	Construction workers; construction plant and equipment; partly-built structures at river crossings and embankments	H	H	H	H	MAJ	ST	INT	H	DEF	H
C	Landslides, mudflows and rockfall from unstable slopes above alignment	Construction workers; construction plant; communities in valley below works	H	H	H	H	MAJ	ST	SMA	H	DEF	H
C	Seismic event causing collapse or damage to partially-built structures	Construction workers at bridge and structure sites; communities adjacent to construction works	M	H	H	M	MAJ	ST	SMA	H	POSS	H

C	Climate-amplified extreme rainfall increasing frequency of all the above hazards during the construction period	Construction workers; plant; communities along 56 km corridor	H	H	H	H	MAJ	ST	INT	H	DEF	H
Operational Phase												
O	Flooding and debris flows damaging or destroying road infrastructure (embankments, bridges, culverts, protection works)	Road infrastructure; road users; communities dependent on the road for access	H	H	H	H	MAJ	LT	INT	H	DEF	H
O	Landslides and rockfall blocking or damaging the road	Road infrastructure; road users; communities dependent on the road	H	M	H	H	MAJ	LT	SMA	H	DEF	H
O	Seismic event damaging bridges or retaining structures	Road infrastructure; road users; communities	H	H	M	H	MAJ	LT	SMA	H	POSS	M
O	Climate change intensifying flood, landslide and debris flow hazards over the operational design life	Road infrastructure; communities dependent on corridor; downstream communities	H	H	H	H	MAJ	LT	INT	H	DEF	H

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minor / LT: Long term / MT: Medium Term / ST: Short term / SMA: Small / INT: Intermediate / EXT: Extensive / DEF: Definitely / POSS: Possible / UNLIKE: Unlikely. Phase: C = Construction; O = Operation.



7.4.5. Mitigation and Management Measures

Natural hazard mitigation for this project operates at two levels: design-level measures embedded in the engineered works (which are fixed by the detailed design and cannot be varied by the Contractor without written Engineer approval), and construction-phase management measures that govern how and when works are carried out in the hazard-exposed environment.

Design-Level Measures (Embedded in Project Design)

Hydraulic Design — All bridges and culverts have been designed to SNiP 2.05.03-84 return period standards for a Category V road (50-year return period for bridges; 33-year for pipe culverts), using a 100-year observed daily rainfall input of 83 mm as the design rainfall. Design flows incorporate debris flow multipliers ranging from 2.6 to 4.8 (with most catchments above 3.5), applied to the liquid discharge to account for the high sediment and boulder content of flows in this system. The non-linear relationship between rainfall input and calculated design flows means that plausible climate-change uplifts in extreme rainfall produce proportionally smaller increases in design flows, providing inherent conservatism against realistic future scenarios.

Bridge Foundations — Piled foundations have been specified for all bridges to address the risk of scour, lateral channel migration, and seismic loading. Prior to commencement of foundation works at each bridge, the Contractor shall carry out site-specific geotechnical investigation to confirm founding conditions and shall obtain written Engineer approval before proceeding. Where investigation reveals conditions materially different from design assumptions, works shall not proceed until a design review has been completed.

Seismic Design — Seismic load calculations have been incorporated into the design of all bridges and retaining structures in accordance with applicable national code requirements. The Contractor must construct to these specifications and must not substitute alternative structural assumptions without written Engineer approval.

Slope Protection — Slope stability assessments have been carried out along the alignment. Material performance specifications for gabion mesh, riprap sizing, and concrete mixes are set by the design and shall not be substituted. The Contractor must not alter slope protection dimensions, materials, or geometry without Engineer approval.

Construction Phase - Flood and Debris Flow Management

Seasonal Scheduling — Foundation works, river crossing works, culvert installation, and embankment construction in the active floodplain shall be scheduled to avoid the peak flood and snowmelt season (approximately April to June) wherever the construction programme permits. The precise seasonal restriction windows shall be confirmed in the Contractor's CESMP in coordination with the Engineer before works commence.

Flood Emergency Response — A Flood Emergency Response Procedure shall be prepared by the Contractor as part of the Emergency Preparedness and Response Plan (Annex 4 and Annex 7 of the ESMP) before any in-river or floodplain works begin. The procedure shall define: action levels for heightened monitoring, partial suspension of works, and full evacuation; designated safe assembly points above flood level at each active river crossing; a named daily river level monitoring responsibility during the wet season; and notification procedures to downstream communities where the Contractor's works could affect flood conveyance.

Floodplain Controls — Storage of spoil, fuel, chemicals, or hazardous materials in mapped flood zones is prohibited at all times. Temporary diversion channels and protective berms at active river crossings and low-lying work fronts shall be installed before works begin in each section. All temporary flood protection works shall be removed on section completion and natural flow restored.



Temporary Access Roads — Temporary access roads shall be designed and constructed with appropriate gradients, cross-drainage, and surface stabilisation to remain passable in wet conditions and to avoid concentrating runoff onto slopes.

Construction Phase — Slope Stability and Rockfall

Cut Slope Management — Works on cut slopes with gradients $\geq 30^\circ$ shall not commence without a slope stability assessment by a qualified geotechnical engineer and approval of the excavation method statement by the Engineer. The maximum height of unsupported cut face permitted at any one time shall be defined in the method statement. Workers shall not access areas below unsupported cut faces under any circumstances.

Slope Protection Installation — Catch berms, rockfall netting, geotextile, and other temporary protection works shall be installed immediately on completion of each cut face. Loose material shall be scaled from cut faces before any worker access is permitted below.

Rainfall Stop-Work Triggers — The Contractor shall define rainfall stop-work trigger levels (mm/hr and cumulative daily) for each work type (earthworks, slope works, in-river works, blasting) in the CESMP. Works on slopes and in flood-prone areas shall be suspended when trigger levels are reached and shall not resume until conditions have been assessed and the Engineer has authorised restart.

Blasting Controls — Blasting shall not be carried out on slopes above occupied structures or near naturally unstable slope features without a specific risk assessment and Engineer approval. Blast vibration monitoring at adjacent slopes is required in addition to the standard vibration monitoring at structures described in the Noise and Vibration section.

Construction Phase — Seismic Events

Temporary Structural Bracing — Method statements for all bridge and retaining structure construction shall include temporary bracing and shoring designs for all intermediate structural states, designed to withstand applicable seismic loads. Method statements shall be submitted to the Engineer for approval before works commence.

Post-Seismic Inspection and Restart — Following any felt earthquake, all works shall be suspended immediately. The ESHS Manager shall inspect all structure sites, cut slopes, and embankments before any restart is authorised. Written sign-off from the Engineer is required before works resume at any location that experienced shaking. Worker seismic awareness training, including evacuation routes and assembly points, shall be delivered at induction and refreshed monthly.

Construction Phase — Climate-Triggered Extreme Events

On-Site Weather Monitoring — The Contractor shall operate an on-site weather station, or subscribe to a verified meteorological monitoring service, throughout the construction period. Daily rainfall shall be logged against defined stop-work thresholds. A pre-season emergency preparedness review shall be completed before each rainy season, confirming that evacuation routes are clear, emergency equipment (pumps, sandbags, spill kits) is inventoried and accessible, and river level monitoring arrangements are in place.

Operational Phase

Operational-phase resilience to natural hazards depends primarily on: the quality of the as-built infrastructure; an effective maintenance regime that detects and repairs hazard damage promptly before it progresses to structural failure; and a programme of periodic review against evolving climate projections. The road operator shall establish annual pre-rainy-season inspections of all hydraulic structures, embankment protection works, and slopes along the corridor. Damage identified shall be prioritised and repaired before the onset of the flood season. Periodic hydraulic and structural review against updated climate projections is recommended every five years or following any flood event that exceeds the design return period.

7.4.6. Residual Impacts

Table 60 provides an assessment of residual natural hazard impacts following implementation of the mitigation measures described above. It is important to note that for natural hazards — particularly those amplified by climate change — residual risk cannot be reduced to zero through design and management measures alone. The assessment below reflects the reduction in risk achievable through good design and construction management, while being clear about irreducible residual exposure.

Table 60: Residual Impacts – Natural Hazards

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Impact Significance
C	Flooding and debris flows	High	Residual risk of flood and debris flow events reaching active work fronts remains, particularly during the wet season. Risk level varies by season and cannot be fully eliminated given the unpredictable nature of flash flood events in this geography.	Low – Medium
C	Landslides, mudflows and rockfall	High	Residual slope instability risk remains on naturally unstable slopes above the alignment unrelated to construction activity, and under climate-amplified precipitation events. Engineered slopes can be controlled; natural slopes above cannot.	Low – Medium
C	Seismic event	High	The probability of a significant seismic event during construction cannot be managed. Residual consequences for workers and partly-built structures remain moderate even with protective measures in place.	Medium
C	Climate-amplified extreme rainfall	High	Residual risk reflects inherent uncertainty in climate projections and the possibility of rainfall events exceeding defined stop-work thresholds.	Low – Medium
O	Flooding and debris flows — infrastructure	High	Structures are designed with substantial conservatism above observed rainfall inputs. Residual risk is low provided annual post-flood inspection and maintenance of protection works are sustained throughout the operational life.	Low
O	Landslides and rockfall — infrastructure	High	Residual risk from naturally unstable slopes above the alignment cannot be eliminated by road design. Regular slope inspection and prompt clearance are required to maintain that risk at Low.	Low
O	Seismic event — bridges and structures	Medium	Structures are designed to applicable seismic code. Residual risk is low provided post-seismic inspection protocols are maintained throughout the operational life.	Low

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Impact Significance
O	Climate change — long-term amplification	High	Design conservatism provides meaningful headroom, but residual risk increases over the 20–30 year operational life as climate change may shift hazard frequencies beyond design-level events. Periodic review against updated climate projections is required to maintain this rating.	Low

7.4.7. Monitoring

Table 61 summarises the natural hazard monitoring requirements for the Project.

Table 61: Monitoring – Natural Hazards

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Equipment
Construction Phase					
Daily rainfall monitoring	Rainfall (mm/day and mm/hr); cumulative totals against defined stop-work thresholds by work type	Daily throughout construction; continuous alert during rainy season	On-site weather station or verified meteorological monitoring service; read at start of each working day	Contractor (ESHS Manager)	Rain gauge or calibrated data-logger on site. Stop-work triggers defined in CESMP by work type (earthworks, in-river, slope works, blasting). Daily log submitted to Engineer; weekly summary report.
River level monitoring	Shurobdaryo level; defined action levels for heightened alert, partial suspension, and evacuation	Daily during wet season (approximately April–June); after any storm event; 24-hour monitoring during sustained or intense rainfall	River gauge at active river crossing and floodplain work fronts; upstream gauge where available	Contractor (ESHS Manager / designated river monitor)	Staff gauge or electronic river level recorder. Action levels and evacuation procedure defined in Flood Emergency Response Procedure (Annex 4 of ESMP). 24-hour incident reports to Engineer after any flood event.
Daily slope inspection	Visual assessment of cut face stability; tension cracks; seepage; signs of incipient movement; rockfall	Daily at all active cut slopes; immediately after any rainfall event ≥ 10 mm; after any blasting event; after	All cut slopes $\geq 30^\circ$ gradient and all natural slopes directly above active work areas	Contractor (Environmental Inspector / Geotechnical Inspector)	Standardised inspection log with photographic record. Slope closure and evacuation if signs of instability identified. No worker access below unsupported

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Equipment
	accumulation on catch berms	any felt seismic event			cut faces. Monthly report to Engineer.
Post-seismic inspection	Structural integrity of all partially-built structures (bridges, retaining walls, culverts, embankments); slope stability at active cuts	Triggered by any felt earthquake; monthly emergency muster drills	All structure sites; all cut slopes above the alignment with active workers	Contractor (ESHS Manager / Structural Inspector)	Inspection checklist per method statement; Engineer sign-off required before works resume after any felt earthquake. Monthly drill records maintained.
Temporary protection installation records	Installation of catch berms, rockfall netting, slope drainage, and protective barriers	Photo record on installation; weekly verification that protection measures remain in place and effective	All completed cut slopes and embankments with active or recently completed works	Contractor (Environmental Inspector)	Photographic log; weekly inspection checklist. Records submitted with monthly ESHS report.
Operational Phase					
Post-event infrastructure inspection	Condition of embankments, bridge structures, culverts, gabion protection, and drainage works after flood, landslide, or seismic events	After each significant flood event, landslide, or felt earthquake; minimum annually before rainy season	All bridges, major culverts, embankment protection works, and slopes along 56 km corridor	PIURR / Road Operator	Standard bridge and road inspection protocol. Photograph record. Priority repair programme issued within 30 days of inspection. Annual pre-season inspection report.
Climate and hydrology review	Review of updated climate projections and observed hydrological data against design assumptions	Every 5 years, or following any flood event exceeding design return period	Corridor-wide review; focus on hydraulic structures and most exposed embankment sections	PIURR / Road Operator (with specialist input)	Desk review of updated NEX-GDDP or equivalent regional climate model outputs against design rainfall inputs. Report to PIURR with adaptive maintenance recommendations if design headroom is assessed as eroded.

7.5. Hydrology

The Shurobdaryo is the defining physical feature of the BSK corridor. The road runs adjacent to or within the active floodplain for extended sections, crosses multiple tributary streams, and requires the construction or rehabilitation of bridges and culverts. Construction activities therefore present direct risks to surface water quality, river morphology, and the communities and ecosystems that depend on the river system. This section assesses those risks and the measures required to manage



them; the detailed management requirements are set out in the Water Quality and Sediment Control Plan (Annex 7 of the Project ESMP), to which this section refers throughout.

7.5.1. Project Activities with Potential to result in impacts to hydrology

The following construction activities have the potential to affect surface water quality, hydrology, or water availability:

- Earthworks, cut and fill, embankment construction, and slope re-profiling — generating sediment-laden runoff that can reach the river and tributaries during rainfall events.
- Bridge construction, culvert installation, and riverbank protection works — requiring direct or near-channel working, disturbing the riverbed, and temporarily altering flow patterns.
- River gravel extraction from the Shurobdaryo and tributaries — the primary identified borrow material, with direct consequences for riverbed disturbance, channel morphology, and aquatic habitat.
- Fuel and chemical storage and handling — presenting spill risk from construction camps, refuelling areas, and plant maintenance zones along the full 56 km corridor.
- Concrete batching and equipment washing — generating highly alkaline washwater that constitutes a polluting discharge if it reaches watercourses.
- Construction camp wastewater and sewage — generating domestic effluent requiring treatment before any discharge.
- Water abstraction from the Shurobdaryo, its tributaries, or groundwater — with the potential to compete with community irrigation and domestic water uses.
- Works near or across irrigation channels and community water intakes — risking disruption to agricultural water supply and domestic water access during the construction period.

During the operational phase, the rehabilitated road will generate runoff from its paved surface. However, the replacement of the current deteriorated and uncontrolled drainage infrastructure with properly designed culverts and roadside drains will represent a material net improvement in the management of road-surface runoff entering the river system.

7.5.2. Sensitive Receptors

The key sensitive receptors for water quality and hydrological impacts are:

- The Shurobdaryo and its tributaries — a mountain river system of high ecological sensitivity supporting confirmed populations of migratory Amu Darya Trout. The river is sensitive to elevated sediment loading, chemical contamination, and physical disturbance of the channel bed.
- Irrigation users — communities along the alignment depend on gravity-fed irrigation channels and intakes from the Shurobdaryo and its tributaries. A single contamination event upstream of an intake can affect multiple downstream users simultaneously. Agriculture is the primary livelihood along the corridor and disruption to water supply during the growing season can result in crop losses that cannot be recovered within that season.
- Domestic water users — Domestic water users --- communities rely primarily on natural spring discharge conveyed through small locally managed pipeline systems, supplemented by direct surface water intakes from the Shurobdaryo and its tributaries. No borehole or well abstraction was identified along the corridor. There is no alternative supply infrastructure in this remote valley; disruption to any spring or surface intake serving a settlement has immediate consequences for drinking water, cooking, and sanitation with no fallback available. Spring-fed supplies are sensitive to ground disturbance near spring catchment and



emergence areas, which can interrupt or divert natural discharge points. Direct river intakes are acutely vulnerable to turbidity, contamination, and physical disruption during in-river and bankside works.

- Downstream communities — the Shurobdaryo drains toward the Panj River on the Tajikistan–Afghanistan border. A significant pollution event has potential transboundary reach, though this risk applies primarily to major spill scenarios rather than routine construction turbidity.

7.5.3. Potential Impacts

Construction Phase

Sedimentation and Turbidity - Earthworks on the steep slopes of the BSK corridor will expose significant areas of loose soil material vulnerable to rainfall erosion. The narrow valley and short runoff pathways mean that sediment mobilised from active work areas can reach the Shurobdaryo rapidly, particularly during the intense spring snowmelt and storm events that characterise the regional climate. Elevated turbidity reduces light penetration and aquatic productivity, fine sediment deposited on gravel beds smothers fish eggs and invertebrate habitat, and sustained high suspended sediment loads cause physiological stress in salmonid fish. For irrigation users, turbid water can block intake screens and, where drawn into domestic supply, require treatment before use. In-river works at bridge and culvert sites will generate localised turbidity plumes through direct physical disturbance of the riverbed; the duration and extent of these plumes will depend on the effectiveness of isolation measures such as cofferdams and turbidity curtains.

Hydrocarbon and Chemical Contamination - A substantial construction vehicle fleet will operate along the full 56 km corridor, with associated fuel storage, refuelling, and maintenance distributed at camps and work fronts throughout. The applicable national standard for total petroleum hydrocarbons (TPH) in discharge to watercourses is 0.05 mg/l — approximately 200 times more stringent than the equivalent IFC EHS Guideline value. At this concentration any visible surface sheen constitutes non-compliance, and the standard should in practice be treated as an absolute prohibition on any hydrocarbon discharge to the river system. A single spill of significant volume — from an overturned fuel tanker, a ruptured storage tank, or an uncontained refuelling incident near the river — could contaminate an extended reach of the Shurobdaryo and its tributaries. Asphalt and bitumen storage introduce additional hydrocarbon risk given the viscous, difficult-to-recover character of bitumen spills.

Concrete and Cement Washwater - Concrete production and placement at bridge and culvert sites generates highly alkaline washwater (typically pH 11–13) from equipment cleaning. This constitutes a polluting discharge that can cause severe pH shock to aquatic life if it reaches the river. The risk is elevated at bridge construction sites given their inherent proximity to the watercourse.

Irrigation and Community Water Supply Disruption - The road widening, culvert replacement, and drainage works will cross or run adjacent to irrigation channels and community water intakes at multiple points along the corridor. Physical disruption or blockage of these systems, even temporarily, can result in crop losses within the current growing season that cannot be recovered. Communities in this remote valley have no alternative supply infrastructure to fall back on, meaning that even a short-duration disruption has a disproportionately serious consequence for affected households.

Permanent Loss of Riverbank Irrigation Access — Embankment and Bank Protection Works - Along sections of the corridor the road runs directly parallel to the Shurobdaryo, with agricultural land bordering the road on the upslope side. Where landholders currently access the river directly from the bank to draw irrigation water — whether through informal gravity intakes, channel headworks, or direct pump abstraction — the construction of new or raised road embankments, gabion bank protection, and river training structures will physically interpose a permanent engineered barrier between the agricultural land and the active channel. This is a distinct operational phase impact from temporary construction disruption: it is permanent, affects the landholders' ability to irrigate



regardless of whether the construction works themselves damaged any channel, and is not captured by the RP survey figure of four affected irrigated parcels, which reflects landholder-reported construction disruption rather than an engineering assessment of post-construction riverbank access. The full extent of this impact is not yet known and requires a targeted pre-construction survey before embankment and bank protection works commence in each section.

Construction Water Abstraction - Concrete production, dust suppression, equipment washing, and potable camp water supply collectively generate significant water demand during construction. Abstraction from the Shurobdaryo or its tributaries during the dry summer period, when river flows are at their lowest and irrigation demand is at its peak, has the potential to reduce flows in ways that affect downstream irrigation. A Water Use Permit from the Basin Water Organisation or Committee for Environmental Protection is required before any abstraction commences.

Borrow Pit and Disposal Area Hydrological Impacts — Active borrow pits and spoil disposal areas located along the corridor generate sediment-laden surface runoff during rainfall events. Where these facilities are located in or near the Shurobdaryo floodplain or tributary catchments — which is structural to the corridor given the alignment runs adjacent to or within the floodplain for extended sections — runoff can reach watercourses with little attenuation, contributing to elevated turbidity and sediment loading. Where disposal occurs within the active floodplain (under the special authorisation route) inadequately engineered placement can constrict flood conveyance, increase local scour, and alter channel morphology, particularly during high-flow events. Borrow pit excavation below the local water table can intercept shallow groundwater, with implications for spring flows and downstream irrigation supply, and disposal of unsuitable excavated material (siltstones, sandy clays) can mobilise fine sediment if surface drainage and toe protection are inadequate.

The specific locations potentially affected by these impacts are the 16 indicative spoil disposal sites — particularly those identified in the floodplain-proximity category (Bridge No. 1 at km 15, Bridge 5 at km 35, Bridge 6 at km 38, plus any other site found on per-site assessment to sit within the active floodplain) — and the three identified borrow reserves (BR1 at km 1–25, BR2 at km 25–30, BR3 at km 33–54), all of which are situated on active floodplain deposits of the Shurobdaryo and require the special authorisation route.

In-River Vehicle Movement and Temporary Access Roads (Including Bank Protection and River Training Works)— Construction at bridge and culvert locations, and at sites requiring in-river works such as bank protection and groynes, will require heavy machinery to operate within the active channel and, in some cases, the establishment of temporary access tracks along or across the riverbed. This results in direct disturbance of the channel substrate, including compaction and reworking of gravels, increasing fine sediment mobilisation and turbidity.

Temporary access roads can alter local flow patterns by constricting the channel, increasing flow velocities and causing localised scour, or conversely creating upstream ponding and sediment deposition. These effects may be more pronounced at river training works where partial obstruction or staged construction modifies flow over longer periods. During high flows, such structures are vulnerable to overtopping or washout, potentially generating downstream sediment pulses.

In-river works such as rock placement and bank reprofiling introduce further disturbance through excavation and material handling in flowing water, with associated turbidity increases and changes to near-bank flow conditions. There is also an elevated risk of hydrocarbon leakage from machinery operating in or near water, where containment is difficult.

From a community perspective, in-channel access may temporarily restrict access to water abstraction points or livestock watering areas. Without careful control of access, timing, and reinstatement, these activities can result in short- to longer-term impacts on channel stability, water quality, and aquatic habitat

Operational Phase



The rehabilitation and paving of the road, combined with properly designed drainage infrastructure, will eliminate the chronic sedimentation and uncontrolled runoff currently generated by the deteriorated surface. Blocked culverts that currently direct concentrated runoff to the river or onto agricultural land will be replaced with adequate structures. This represents a material net improvement for the river and for downstream water users. Bridge deck drainage for spans over 50 m shall be directed to interceptor tanks or filter ponds adjacent to each bridge rather than discharging directly to the watercourse, in accordance with the design requirements. The paved surface will generate diffuse hydrocarbon contamination in road-surface runoff — a standard characteristic of operational roads — but at the low traffic volumes anticipated for this rural corridor, concentrations will be attenuated through properly designed roadside drainage before reaching the river.

Cumulative and Transboundary Impacts

No other major sources of water quality pressure are identified in the Shurobdaryo catchment within the project area of influence. The principal cumulative concern is the interaction of construction water abstraction with existing agricultural irrigation demand during the dry season, which is addressed through the Water Use Permit process. The Shurobdaryo drains ultimately to the Panj River on the Tajikistan-Afghanistan border. Routine construction turbidity and sediment impacts are not expected to reach transboundary significance given downstream attenuation. A significant fuel spill reaching and travelling down the river system would however represent a credible transboundary risk and reinforces the importance of spill prevention and rapid response as the primary controls.



7.5.4. Impact Summary and Assessment of Significance

Table 62 provides an assessment of the significance of potential water resources and hydrology impacts before implementation of the proposed mitigation measures. The operational drainage improvement impact is assessed as positive and included for completeness.

Table 62: Impacts and Significance – Hydrology

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
Construction Phase												
C	Sedimentation and elevated turbidity from earthworks and in-river works	Shurobdaryo and tributaries; aquatic habitat; any darya trout; downstream irrigation intakes and water users	H	H	H	H	MAJ	ST	INT	H	DEF	H
C	Borrow pit and disposal area hydrological impacts — sediment-laden runoff to watercourses; floodplain disposal effects on channel morphology and conveyance; groundwater interception	Shurobdaryo and tributaries; downstream irrigation and domestic water users; spring-fed water supplies	M	H	M	H	MOD	ST	INT	M	POSS	M
C	Hydrocarbon or chemical spill contaminating the Shurobdaryo or tributaries	Shurobdaryo; aquatic habitat; downstream water users and irrigation intakes	H	H	H	H	MAJ	ST	INT	H	POSS	H

C	Concrete and cement washwater discharge	Shurobdaryo and tributaries; aquatic life; downstream water users	M	H	M	H	MOD	ST	SMA	M	POSS	M
C	Disruption to irrigation channels and community water supplies	Communities dependent on irrigation; households reliant on springs and surface intakes along corridor	H	H	H	M	MAJ	ST	SMA	H	DEF	H
C	Construction water abstraction competing with community and agricultural uses	Downstream irrigators; domestic water users	M	M	M	M	MOD	ST	SMA	M	POSS	M
C	Camp wastewater and sewage	Shurobdaryo; springs and groundwater used by downstream communities	M	H	M	H	MOD	ST	SMA	M	POSS	M
C	River gravel extraction — channel morphology and downstream sediment regime	Shurobdaryo channel; downstream sediment regime; amu darya trout spawning gravels	H	H	H	H	MAJ	ST	INT	H	DEF	H
Operational Phase												
O	Improved road drainage reducing uncontrolled runoff and	Shurobdaryo; aquatic habitat; irrigation water users; downstream communities	H	H	L	L	MIN	LT	INT	L	DEF	+



	sedimentation to river											
O	Diffuse road-surface runoff (hydrocarbons, tyre particles) during operation	Shurobdaryo; aquatic habitat; irrigation intakes; downstream water users	H	M	L	L	MOD	LT	INT	L	DEF	L

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minor / LT: Long term / MT: Medium Term / ST: Short term / SMA: Small / INT: Intermediate / EXT: Extensive / DEF: Definitely / POSS: Possible / UNLIKE: Unlikely. Phase: C = Construction; O = Operation.

7.5.5. Mitigation and Management Measures

The detailed mitigation and management requirements for water resources and hydrology are set out in the Water Quality and Sediment Control Plan (Annex 7 of the Project ESMP) and the Erosion and Sediment Control Plan (Annex 15 of the Project ESMP). This section summarises the principal measures by impact type; the Project ESMP annexes contain the full procedural requirements and shall be read alongside this section.

Design Phase

Drainage structures have been designed to SNiP 2.05.03-84 return period standards for a Category V road, using a 100-year observed daily rainfall input and debris flow multipliers providing substantial conservatism against climate-amplified events, as described in the Natural Hazards section. Bridge deck drainage for spans over 50 m shall be directed to interceptor tanks or filter ponds rather than discharging directly to watercourses beneath the bridges, capturing accumulated hydrocarbons and sediment during dry periods before they are mobilised by rainfall.

Pre-Construction Phase

Before any works commence, the Contractor shall prepare a site-specific Water Quality and Sediment Control Plan in accordance with the Annex 7 of the Project ESMP, which shall include GPS-referenced monitoring station locations, a register of all community water abstractions and irrigation intakes along the route, and the construction Water Demand Schedule. Water Use Permits from the Basin Water Organisation or Committee for Environmental Protection shall be obtained before any abstraction from the Shurobdaryo system. A Discharge Permit shall be obtained before any treated effluent from camp facilities is discharged to watercourses or soil. The SCLO shall conduct a community water source audit, documenting the location, use type, and dependent community for every spring, irrigation intake, and domestic water point along the 56 km corridor, before works reach each section.

All borrow pit, spoil disposal, plant, and camp locations shall additionally comply with the water protection zone provisions of the Tajik Water Code (2000, as amended; Articles 122, 129, 130, 144) and the Law on Environmental Protection (2014, Article 20). The applicable water protection zone widths for the Shurobdaryo and its tributaries shall be confirmed through the project-specific CEP environmental permit and Special Water Use Permit obtained pre-construction, and recorded in the Legal and Permits Register.

Construction Phase

Sedimentation and Turbidity — The primary sediment control measures are: silt fences at the downslope perimeter of all active earthworks within 100 m of any watercourse; sedimentation ponds where large disturbed areas drain to a single discharge point; progressive stabilisation of completed earthwork sections; and pre-season protection of all exposed slopes and stockpiles before the spring snowmelt. For in-river works, cofferdams shall isolate active work zones from flowing water, with dewatering pumped to a settlement area rather than discharged directly. Turbidity curtains shall be deployed downstream of in-river works wherever practicable. In-stream works shall be scheduled to avoid the peak flood season (April–June) where the programme permits, and shall not be undertaken during the fish spawning exclusion period (1 November–28 February). A minimum 15 m undisturbed riparian buffer shall be maintained along the banks of the Shurobdaryo and major tributaries wherever the alignment permits.

Hydrocarbon and Chemical Contamination — All fuel and chemical storage shall be in bunded secondary containment sized to 110% of the largest vessel, on an impermeable base, at a minimum of 200 m from any watercourse. Refuelling shall take place only at designated bunded points; refuelling within 50 m of a watercourse is prohibited. Used oil shall be disposed of through licensed waste contractors. Spill kits shall be maintained at all fuel storage and batching areas. Any spill



reaching or threatening a watercourse shall trigger the Emergency Spill Response Procedure (Annex 7 of the ESMP), with the Engineer notified within one hour.

Concrete and Cement Washwater — Concrete equipment shall be washed out only at designated areas with impermeable lining and settlement chambers, located at a minimum of 50 m from watercourses. No concrete washwater shall be discharged to any watercourse or to soil within 50 m of a watercourse.

Community Water Supplies and Irrigation — Works near irrigation channels and community intakes shall be planned in advance and communicated to communities via the SCLO with at least 48 hours' notice. Where disruption is unavoidable, an alternative supply of equivalent quality and quantity shall be provided within 24 hours and maintained until the permanent supply is fully restored. All disrupted infrastructure shall be reinstated to pre-construction condition before the Contractor demobilises from each section.

Riverbank Irrigation Access - Before any embankment raising, bank protection, or river training works commence in each section, the SCLO shall survey and record all points at which landholders currently access the Shurobdaryo or any tributary directly for irrigation abstraction, including informal gravity intakes, channel headworks, and pump abstraction points. The survey shall be GPS-referenced, identify the landholder, the area irrigated, and the season of use. Where active irrigation access points are confirmed within the construction footprint, the design shall incorporate a passage through the embankment or bank protection structure — such as a culvert, pipe sleeve, or maintained access gap — to preserve equivalent access to the river after construction. Where this is not technically feasible, an alternative water source of equivalent reliability and quantity shall be agreed in writing with the affected landholder before works at that location commence, and compensation for any resulting permanent loss of irrigation access shall be assessed and paid through the RP framework before works begin. This survey and its outcomes shall be submitted to the Engineer for approval before works reach each section.

Construction Water Abstraction — Abstraction shall not commence without a valid Water Use Permit. Water meters shall be installed at all abstraction points before use and consumption recorded monthly.

River Gravel Extraction — Extraction shall be confined to approved locations in the Borrow Area Register, with seasonal exclusion (November–February), minimum setbacks from the active channel and identified spawning gravels, and mandatory progressive reinstatement. The full extraction controls are set out in Annexes 7 and 8 of the ESMP.

Borrow Pit and Disposal Area Surface Drainage and Floodplain Controls — Active borrow pits and spoil disposal areas shall be subject to the siting and operational controls in ESMP Annex 6 §3.2 (borrow) and §4.2 (spoil), reinforced by BMP Annex 8 §5.3. Perimeter cut-off ditches and toe protection shall be installed before excavation or placement commences, designed to intercept surface runoff and direct it to sedimentation ponds or filter pads before discharge. Spoil shall be placed in engineered layers ≤500 mm with slopes ≤1:2, with geotechnical sign-off for sites >5,000 m³. Stockpiles of fine or unsuitable material shall be covered or progressively reinstated. Floodplain disposal is permitted only via the special authorisation route in Annex 6 §4.2 (water authority and Engineer authorisation), with equivalent hydraulic and aquatic biodiversity screening to that required under ESAP item 6.6 for floodplain borrow extraction. Borrow pit excavation that intercepts shallow groundwater shall trigger immediate written notification to the Engineer and a hydrogeological assessment before further extraction; pumped groundwater shall be passed through settlement before release to surface waters. Per-load tracking, weekly site inspections, and post-rainfall inspections (≥10 mm) are mandatory (C-SG-02, C-SG-05, C-SG-06).

In-River Access and Working Controls (Vehicles, Temporary Access Roads, and River Training Works) — In addition to the general sediment and pollution controls above, the following specific measures shall

apply to any works requiring access within the active channel (including bridge works, bank protection, and groyne installation):

- **Access Limitation and Approval** — All in-river access points and routes shall be predefined in method statements and approved by the Engineer. Ad hoc access within the channel is prohibited. The number, width, and duration of access routes shall be minimised.
- **Channel Obstruction Control** — Temporary in-channel access roads and structures shall not reduce the active channel cross-section below design flood capacity. All temporary works shall be approved by the Engineer before installation.
- **Material Specification for Access Tracks** — Only clean, coarse, non-erodible material (e.g. well-graded rock) shall be used for temporary access within the riverbed. Fine materials, soils, or construction waste shall not be placed in the active channel.
- **Vehicle Movement Restrictions** — Repeated trafficking within wetted areas shall be avoided. Machinery shall operate from dry or isolated working areas wherever practicable. Crossing of flowing water shall be limited to designated points only.
- **Staged Construction of River Training Works** — Bank protection, groynes, and similar structures shall be constructed in stages to limit the extent of in-channel disturbance at any one time. Direct placement of material into flowing water shall be minimised.
- **High-Flow Contingency** — Temporary in-channel access roads and structures shall be designed for rapid removal or stabilisation in advance of forecast high-flow events. No in-river works shall proceed when flows are elevated or rising.
- **Bed and Bank Reinstatement** — Upon completion, all temporary access routes and disturbed areas shall be fully removed and the riverbed restored to pre-construction profile and substrate condition, including re-establishment of natural flow paths.
- **Protection of Community Access** — Existing informal access points for water abstraction and livestock shall be maintained or temporarily reinstated in consultation with affected users.

Operational Phase

No specific additional operational mitigation measures are required beyond the properly designed and maintained drainage infrastructure forming part of the road design. The road operator shall maintain drainage outfalls and culverts in good working order and shall carry out annual inspections to check for blockage, outfall erosion, and signs of hydrocarbon contamination at discharge points adjacent to the river.

7.5.6. Residual Impacts

Table 63 summarises residual water resources and hydrology impacts following implementation of the mitigation measures described above and in the ESMP.

Table 63: Residual Impacts – Hydrology

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Impact Significance
C	Sedimentation and turbidity	High	Residual sediment inputs will be temporary and confined to active work periods and rainfall events. Risk varies with rainfall intensity and proximity of works to the river.	Low – Medium

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Impact Significance
C	Borrow pit and disposal area hydrological impacts	Medium	With perimeter drainage, sedimentation control, engineered placement, the floodplain authorisation route, and the groundwater monitoring protocol in place, residual hydrological impacts from borrow pits and disposal areas will be confined to localised, manageable events. Residual risk is concentrated at floodplain-proximity sites and during peak rainfall periods.	Low
C	Hydrocarbon and chemical spill	High	Routine spill risk is well-managed. Residual risk centres on a low-probability, high-consequence event such as an overturned fuel tanker adjacent to the river, where consequence management is the key remaining control.	Low
C	Concrete and cement washwater	Medium	No material residual risk with dedicated washout areas and prohibition on discharge near watercourses in place.	Not Significant
C	Disruption to irrigation and water supplies	High	Disruptions will be temporary and managed. Residual risk is low given the mandatory alternative supply and restoration obligations.	Low
C	Construction water abstraction	Medium	Abstraction will not compete materially with community needs with permits and metering in place.	Not Significant
C	Camp wastewater and sewage	Medium	Properly designed sanitation systems will reduce camp-sourced watercourse contamination to a level of no material residual risk.	Not Significant
C	River gravel extraction	High	Residual morphological disturbance depends on actual extraction volumes. Biodiversity section addresses residual impact on spawning gravels.	Low
O	Improved drainage — positive effect	Positive	Replacement of deteriorated drainage and road paving will eliminate chronic uncontrolled runoff — a material improvement on the current baseline.	Positive
O	Operational road-surface runoff	Low	Diffuse contamination from a rural road at this traffic volume is a low-level chronic impact inherent to road operation.	Low

7.5.7. Monitoring

Table 64 summarises the water resources and hydrology monitoring requirements for the Project. Full monitoring protocols are set out in Annex 7 of the ESMP.

Table 64: Monitoring – Water Resources and Hydrology

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Equipment
Construction Phase					
Surface water quality — baseline and routine	pH (6.5–8.5); turbidity/TSS (national MAC); dissolved oxygen (≥ 6 mg/l); BOD; TPH (0.05 mg/l limit); faecal coliforms; visual (colour, sheen, odour)	Baseline once before construction commences in each section; routine quarterly minimum; monthly during spring snowmelt (April–June); event-triggered after any rainfall > 25 mm/24 hr, visible turbidity increase, or spill	Minimum 5 stations: upstream reference (W-01); downstream of major bridge works (W-02); downstream of primary borrow/camp area (W-03); nearest community water abstraction point downstream (W-04); final downstream station (W-05). Additional stations at major tributary crossings as works progress.	Contractor (Environmental Inspector); Engineer verification	Accredited laboratory for chemistry; calibrated field meters for pH, DO, turbidity in situ. Exceedance reported to Engineer within 24 hours with corrective action plan. Quarterly summary in ESHS Monitoring Report.
Post-spill water quality	TPH; pH; visual observation; parameters relevant to the spilled substance	Within 4 hours of any spill reaching or threatening a watercourse; then at 24-hour intervals until parameters return to baseline	Nearest downstream station to spill; W-04 (community abstraction) as priority	Contractor (ESHS Manager); Engineer notified within 1 hour	Emergency field sampling per Spill Response Procedure (Annex 7 of the ESMP). Incident report to Engineer within 48 hours.
Camp discharge water quality	pH; TSS; BOD; faecal coliforms; TPH; compliance with Discharge Permit conditions	Monthly during camp operation	Discharge point from each construction camp sanitation system	Contractor (ESHS Manager)	Samples collected at discharge point. Results compared to Discharge Permit limits. Non-compliance reported to Engineer within 24 hours.
Community water supply continuity	Continuity of supply; water quality at point of use; community confirmation of restoration	Pre-construction audit; continuous attention wherever works are within 500 m of a community water source; written restoration sign-off before	All community springs, irrigation intakes, and domestic water points along the 56 km corridor — locations registered in the Water Source Audit (Annex 7 of the ESMP)	SCLO; Contractor (ESHS Manager)	Pre-construction register of all sources with GPS coordinates and dependent community. Any disruption triggers 24-hour alternative supply obligation. Restoration confirmed in writing with community representative.

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Equipment
		section demobilisation			
Construction water abstraction	Volume abstracted (m ³ /month); compliance with Water Use Permit conditions	Monthly meter readings at all abstraction points	All Contractor abstraction points on Shurobdaryo, tributaries, and any groundwater sources	Contractor (ESHS Manager)	Water meters installed before any abstraction commences. Monthly log submitted to Engineer. Permit copies on file.
Operational Phase					
Operational road-surface runoff	pH; turbidity/TSS; TPH; visual observation at drainage outfalls	Annually during the first three years of operation; thereafter if complaints or adverse trends are identified	Drainage outfalls discharging to the Shurobdaryo and major tributaries; nearest community abstraction point downstream of road	PIURR / Road Operator	Grab samples at drainage outfalls during or after rainfall events. Annual report to PIURR. Hydrocarbon interceptors to be investigated at priority outfalls if TPH exceedance detected.

7.6. Climate Change

Climate change is not a discrete impact topic for the BSK project in the same way as, for example, air quality or noise. It is a cross-cutting condition that amplifies physical hazards the corridor is already exposed to and accelerates the degradation of every infrastructure material under stress. The sections on Natural Hazards, Water Resources, and Soils and Geology each address climate change as a factor within those topics. This section draws those threads together, presents the findings of the project's dedicated Climate Risk and Adaptation Assessment (CRA), explains how the project has translated those findings into design responses, and assesses the residual climate change risk that will need to be managed over the operational life of the road.

7.6.1. Climate Risks and Adaptation Assessment

A CRA was prepared during 2023 using two complementary datasets. Monthly climate projections were drawn from the WorldClim dataset (IPCC6), providing 1 km resolution data for the periods 2041–2060 and 2061–2090. Daily climate projections were drawn from the NASA NEX-GDDP dataset (25 km resolution), which was used to derive extreme climate indices using the ClimPACT2-Tool developed by the University of New South Wales. Both datasets were analysed under two shared socio-economic pathways: SSP370 (intermediate emission scenario) and SSP585 (high emission scenario). For most road infrastructure components, projections to 2050 are the primary reference horizon; for bridge structures, projections to 2070 were also examined given their longer design life.

The CRA assessed seven extreme climate indices — consecutive dry days (CDD), consecutive wet days (CWD), total annual precipitation (PRCPTOT), daily maximum rainfall (RX1DAY), frost days (FD), annual maximum daily temperature (TXM), and annual minimum daily temperature (TXN) — for the northern (km 0–28) and southern (km 28–56) sections of the corridor at return periods of 25, 50, and 100 years. The modelling used a median ensemble of eight global climate models (GCMs) from the CMIP6 framework to address uncertainty inherent in any single model.

Alongside the climate modelling, a field-based hazard survey was conducted using geolocated ODK tablet forms, recording nearly 100 discrete hazard locations along the alignment. Floods were the



most frequently identified hazard, followed by landslides and rockfall, consistent with the physical character of the corridor described in the Natural Hazards section.

Projected Climate Changes

The CRA projections indicate a corridor experiencing marked intensification of both thermal and hydrological extremes by mid-century. Table 65 summarises the principal findings.

Table 65: CRA Main Findings

Climate Parameter	Current Baseline (1970–2000)	2050 Projection — Intermediate (SSP370)	2050 Projection — High Emission (SSP585)
Average monthly maximum temperature	8–32°C	Increase of >3°C; up to 38°C monthly max	Increase of ~4°C; approaching 40°C monthly max
Annual maximum daily temperature (100-yr event)	~41°C (north); ~44°C (south)	~52°C (north); ~52°C (south)	>50°C throughout corridor
Total annual precipitation	~570–640 mm/year	+5–9% increase	+6–8% increase
Daily maximum rainfall — average (RX1DAY)	~88–100 mm/day	~4–5% increase (intermediate scenario)	>140% increase (high emission scenario)
Daily maximum rainfall — 100-yr event (RX1DAY)	~145–177 mm/day	~144–164 mm/day (slight decrease at 100-yr level)	~592–689 mm/day (very large increase at 100-yr level, high uncertainty)
Consecutive wet days	~57–66 days/year	Broadly similar to baseline	Decrease of ~18–27% — fewer wet days but more intense events
Frost days (FD)	~177–206 days/year	Decrease of ~10%	Decrease of ~10–12%

Source: CRA (2023), based on WorldClim IPCC6 and NASA NEX-GDDP datasets, median ensemble of 8 GCMs under SSP370 and SSP585.

Several of these projections have direct design relevance and are discussed in detail below. Two warrant specific attention for their implications for the project.

The first is the projected increase in daily maximum rainfall. Under the intermediate scenario (SSP370), the average RX1DAY increases modestly (approximately 4–5%), and at the 100-year return period level the modelled values are broadly consistent with or slightly below current values — a counterintuitive result that reflects model uncertainty rather than a genuine projection of reduced extremes at high return periods. Under the high-emission scenario (SSP585), the average RX1DAY increases by more than 140%, and 100-year daily rainfall values reach 592–689 mm/day in the model output. These very high values under SSP585 carry significant uncertainty; they represent the tail of a high-emission global trajectory applied through a regional model at 25 km resolution across complex mountain terrain, a configuration known to amplify uncertainty in precipitation projections.

The second is the projected increase in maximum daily temperatures. Under both scenarios, annual maximum daily temperatures are projected to increase beyond 50°C at the 100-year return period by 2050. Monthly average maximum temperatures are projected to approach 40°C. This has direct implications for pavement material specification.

Projected Hazard Intensification along the Corridor

The CRA's hazard field survey identified nearly 100 discrete hazard locations. The risk matrix produced from the CRA, combining hazard exposure with vulnerability, rated floods as High risk for the majority of the corridor, with the highest-risk sections at km 0–16, km 30–35, and km 45–50, where the alignment runs closest to the active channel and flood depths at the 100-year return period range from 107 cm to over 318 cm. Landslides and erosion are rated High risk at km 5–10, where the alignment cuts through steep, geomorphologically active terrain on the river's north bank. Extreme



heat is rated moderate risk throughout the corridor. Permafrost is not a concern at the project's elevation range of 926–1,658 m above sea level.

Climate change acts on these existing hazard patterns primarily by increasing the frequency and magnitude of the triggering events — rainfall intensity for floods, landslides, and debris flows; maximum temperatures for pavement performance. The corridor is therefore moving along an existing hazard trajectory rather than facing entirely new hazard types, but the direction of travel increases exposure across the operational design life.

The Rainfall Input Question — Observed Data versus Modelled Projections

A specific question arises from comparing the CRA's modelled daily rainfall values against the 83 mm figure used as the 100-year daily rainfall input in the hydraulic design. The CRA's NEX-GDDP ensemble model produces current-conditions 100-year daily rainfall values of approximately 145–177 mm for the northern and southern sections of the corridor respectively. UNDP and ADB regional assessments have cited similar values in the range of 132–177 mm. These figures are consistently higher than the 83 mm station-based observation, and the question of how to reconcile them is material to the climate resilience case for the project.

The position adopted in this assessment, and set out in detail in the Natural Hazards and Water Resources sections, is as follows. The 83 mm figure is derived from observed meteorological station records at Khovaling and Kangurt — the only station-based, physically measured rainfall data available for this location. It represents the 100-year daily rainfall (1% annual exceedance probability) as determined from the local observational record. The NEX-GDDP and comparable figures are outputs of regional climate models or statistical interpolation procedures applied at 25 km resolution across a region characterised by highly localised, topographically driven rainfall variability. In complex mountain terrain, where precipitation is strongly influenced by valley aspect, elevation gradients, and mesoscale circulation features that cannot be resolved at 25 km, regional model estimates carry substantial uncertainty at the specific project location. Known biases in global and regional climate models toward overestimation of precipitation in data-sparse mountain environments further reduce the weight that should be given to modelled values relative to local observations. In the hierarchy of evidence for site-specific engineering design, observed station data is the more reliable local estimate; asking the design to be validated against modelled figures inverts this hierarchy.

Beyond the question of which rainfall input figure is most reliable, the design methodology provides two additional layers of conservatism that insulate the final design flows from any uncertainty in the rainfall input. The first is the use of a 100-year rainfall figure as the input for structures required by SNiP 2.05.03-84 to meet only 33–50 year design standards — an overdesign margin that is structural and deliberate. The second is the two-step calculation process by which the rainfall depth is converted to a design flow: the non-linear runoff formula (with coefficients of 0.56 for smaller catchments and 0.45 for larger ones) means that a proportional increase in rainfall produces a proportionally smaller increase in calculated liquid runoff; and the debris flow multipliers — ranging from 2.6 to 4.8 with most catchments above 3.5, applied to the liquid runoff figure — amplify the final design flow by a factor of three to five relative to the liquid discharge. To illustrate: at Doshmandi (PK 188+50), a liquid flow of 8.61 m³/s becomes a design flow of 35.8 m³/s after a coefficient of 4.16; at Pasivaram (PK 238+00), a liquid flow of 30.7 m³/s becomes 127 m³/s at a coefficient of 4.14. Because the debris flow coefficient is determined by catchment physical characteristics — slope gradient, channel morphology, and erodibility — rather than by the rainfall input, even a substantial increase in the rainfall figure would produce a far smaller proportional increase in the final design flow than the multiplier itself already applies. The design therefore has material headroom to absorb both rainfall input uncertainty and climate change uplifts within the plausible range for this region.

It should also be noted that the mission note prepared by the independent hydrological expert following the site visit in December 2025 acknowledged the limited data basis of the hydrological study — a single rainfall station, no flow gauges on the Shurobdaryo — and recommended the



application of a 20% safety factor to design flows to account for possible climate change related increases, particularly in rainfall intensity. The debris flow multipliers applied in the design substantially exceed this recommendation, providing a margin of conservatism against climate-amplified events that is far larger than the 20% factor suggested as a minimum.

The principal residual risk identified in the mission note — and endorsed in this assessment — is not hydraulic capacity exceedance under climate-amplified peak flows, but physical blockage of culvert openings by transported boulders and debris. This is addressed through: specification of clear-span structures at the most exposed crossings; maintenance provisions requiring pre-rainy-season inspection and clearance of all drainage structures; and the operational monitoring programme described in this section.

Project Activities with Potential Climate Change Implications

The following project activities are specifically relevant to climate change impact:

- Hydraulic structure design and construction — bridges, culverts, and drainage works must be designed for projected climate-amplified flows over their operational life.
- Embankment and slope protection construction — protection works must be designed and specified for the material degradation environment projected under climate change, including higher sediment abrasion, peak temperatures, and thermal stress cycles.
- Pavement design and material selection — asphalt mix and binder composition must be selected to perform under projected maximum temperatures.
- Construction programme and management — works in the floodplain and on slopes must account for the possibility of more frequent and intense rainfall events during the construction period than historical patterns would suggest.

7.6.2. Sensitive Receptors

The sensitive receptors for climate change impacts are:

- Construction workers — workers at active construction fronts in the floodplain, on river crossings, below cut slopes, and at bridge sites are the most acutely exposed receptors during construction. Climate-amplified flooding, flash floods on tributary catchments, and intensified rainfall-triggered slope failures all increase the probability of a serious or fatal event at these work fronts relative to historical hazard frequencies.
- Partly-built structures — bridges, embankments, culverts, and retaining structures under construction are inherently more vulnerable to flood, debris flow, and seismic events than completed structures designed to full specification. Climate-amplified events during the construction window increase the risk of damage to or loss of partly-built works, with cascading consequences for programme, structural integrity, and cost.
- Road infrastructure — embankments, bridges, culverts, slope protection works, and pavement, all of which will be exposed to climate-amplified hazards over the 20–25 year operational design life.
- Communities along the corridor — the 19 settlements that depend on the road as their primary access route to services, healthcare, markets, and emergency response. Climate-amplified road closures have direct welfare consequences.
- Road users — exposed to the consequences of climate-driven infrastructure failure including bridge collapse, rockfall, and flooding of the carriageway.
- Agricultural land and irrigation systems — subject to increased risk from climate-amplified flood and debris flow events during both construction and operation.



7.6.3. Potential Impacts

Climate change does not introduce hazard types that are absent from the baseline. The flooding, landslides, rockfall, debris flows, and extreme temperatures assessed in Section 7.3 (Natural Hazards) and the hydrological impacts assessed in Section 7.4 (Hydrology) are already present conditions at the BSK corridor. What climate change does is shift the frequency distribution of events upward — making events that currently occur at a given return period more frequent, and introducing event magnitudes that may exceed what the historical record encompasses. The impacts assessed in this section should therefore be read as amplifications of the underlying hazard and hydrological impacts described in those sections, rather than as independent additional impacts. Cross-references to Sections 7.3 and 7.4 are noted throughout.

Construction Phase Impacts

Intensification of Flood and Debris Flow Risk During Construction - The construction phase is the period of greatest acute exposure to climate-amplified flooding and debris flow events. As described in Section 7.3.3, the alignment runs within or adjacent to the active floodplain of the Shurobdaryo for extended sections, with 100-year flood depths reaching approximately 150 cm at km 0–5 and up to 263 cm at km 10–16, and peak discharges estimated at approximately 653 m³/s with localised velocities potentially exceeding 7 m/s in constricted sections. These figures are derived from the historical observational record at Khovaling and Kangurt stations and represent the design baseline.

Climate change shifts this baseline upward during the construction window. Under the intermediate SSP370 scenario, average daily maximum rainfall (RX1DAY) is projected to increase by approximately 4–5% above the 1970–2000 baseline; under SSP585, the average RX1DAY increases by more than 140%, with 100-year return period values reaching 592–689 mm/day in the ensemble model output. As discussed in the Rainfall Input section above, the SSP585 tail values carry high uncertainty in complex mountain terrain, and the design has material conservatism to absorb uplifts within the plausible range. However, even under the intermediate scenario, the practical effect during a 36-month construction period is a higher probability of encountering events at or near current design return period levels than the historical frequency alone would suggest. Workers at in-river and floodplain work fronts — particularly at bridge crossings, embankment protection works, and culvert installations within the km 0–16, km 30–35, and km 45–50 sections identified in the CRA as highest flood risk — face correspondingly elevated exposure. Tributary catchments generating flash floods with very short warning times remain the most acute safety risk, particularly given that high-energy debris-laden flows can rapidly overwhelm temporary protective works such as cofferdams that would contain a clear-water event of similar peak discharge.

Intensification of Slope Instability During Construction - Climate-amplified short-duration rainfall intensification directly increases the probability of slope failures on freshly cut faces during the construction period. As detailed in Section 7.3.3, the corridor has nearly 100 documented landslide, debris flow, and rockfall hazard locations, and construction activity compounds natural instability by undercutting slopes and creating exposed faces during the window before permanent protection is installed. Under a climate trajectory where the intensity of triggering rainfall events increases, the probability of a significant failure occurring during this vulnerable construction window is higher than historical rainfall patterns would predict. The sections at km 5–10, where the alignment cuts through steep geomorphologically active terrain on the north bank, and the sections immediately upstream and downstream of km 31 where valley sides constrict, carry the highest concurrent exposure from both slope and flood hazards. The construction programme must treat the historical hazard record as a minimum baseline for planning seasonal scheduling and stop-work trigger levels, not as a reliable predictor of conditions during works.

Amplification of Sedimentation, Water Quality, and Irrigation Impacts During Construction - Climate-amplified rainfall events during the construction period will intensify the hydrological impacts described in Section 7.4.3. More intense rainfall events mobilise greater volumes of sediment from



active earthworks, increasing turbidity pulses to the Shurobdaryo and the risk of impacts on the Amu Darya Trout population and on downstream irrigation intakes. The short runoff pathways in this steep mountain valley mean that sediment mobilised from disturbed areas can reach the river rapidly, with limited opportunity for natural attenuation. Climate-intensified events also increase the probability of overtopping or failure of temporary control measures — silt fences, cofferdams, turbidity curtains — whose design capacity may not fully account for the upper tail of the projected rainfall distribution. For communities dependent on spring and surface water intakes with no alternative supply infrastructure, a climate-amplified construction-phase turbidity event during the irrigation season carries the same disproportionate consequence as any other supply disruption described in Section 7.4.3: crop losses that cannot be recovered within the season. Additionally, extreme rainfall events during construction increase the probability of accidental fuel or chemical spills reaching the river — overturned plant, submerged storage areas, or breached containment during high-flow events — creating a higher frequency of the low-probability, high-consequence hydrocarbon contamination scenarios assessed in Section 7.4.3.

Construction Programme and Cost Disruption - Climate-amplified extreme rainfall events increase the expected frequency of stop-work days during construction across all work types. For earthworks, slope works, in-river works, and blasting, defined rainfall stop-work triggers will be exceeded more frequently than historical averages would suggest, directly extending the construction programme for weather-dependent activities. This is not a safety or environmental failure — the stop-work triggers exist precisely to prevent it — but represents a programme and cost risk that the project preparation documents should acknowledge as a climate-related uncertainty. The risk is concentrated in the spring and early summer period when snowmelt and peak rainfall coincide, which is also the highest-risk period for flood and slope events and during which in-river works should already be minimised by seasonal scheduling.

Operational Phase Impacts

Long-Term Intensification of Flooding, Debris Flows, and Associated Infrastructure Risk - Over the 20–25 year operational design life, the trajectory of climate change implies a progressive increase in the frequency and magnitude of flood and debris flow events above the historical baseline. The consequences for the rehabilitated road are those set out in Section 7.3.3 for the operational phase — bridge scour, embankment overtopping and washout, culvert capacity exceedance and blockage, and damage to gabion and concrete protection works — occurring at increasing frequency relative to the current baseline. The design provides substantial conservatism through the 100-year observed rainfall input and debris flow multipliers of 2.6–4.8 (most catchments above 3.5), which are determined by catchment physical characteristics rather than the rainfall input and therefore absorb a proportionally larger share of any climate uplift in precipitation than the rainfall figure alone would suggest, as detailed in Section 7.3.3 and in the Rainfall Input discussion above. However, as the operational design life extends toward 2045–2050 under the mid-range scenarios, the risk that events exceed the design return period increases, and adaptive maintenance remains the essential long-term management response. Communities along the corridor — particularly the approximately 19 settlements identified as sensitive receptors in Section 7.3.2 — face the welfare consequences of climate-amplified road closures regardless of whether those closures result from infrastructure damage or temporary inundation of the carriageway.

Pavement Performance Under Climate-Projected Extreme Temperatures - The CRA projects annual maximum daily temperatures of approximately 52°C under SSP370 and in excess of 50°C throughout the corridor under SSP585 at the 100-year return period by 2050. Road surface temperatures under direct summer sun characteristically exceed air temperatures by 10–20°C, meaning pavement surface conditions at the upper tail of the projected temperature distribution could approach or exceed 70°C. At these temperatures, conventional asphalt binders approach or exceed their softening point, causing rutting and surface deformation under repeated traffic loading, loss of surface skid resistance, and bitumen bleeding to the surface. This impact is concentrated on south-facing sections in the lower



valley where solar exposure is greatest and on sections where valley topography limits airflow. The impact is operational in nature — affecting road users, maintenance budgets, and road safety — rather than a structural failure risk, but it directly affects the performance of the rehabilitated road against the purpose for which it is being built.

Accelerated Material Degradation of Protection Works - Climate-amplified debris flow frequency and magnitude increases the rate of abrasion and impact damage to gabion mesh and concrete protection works beyond the baseline assumptions embedded in standard maintenance intervals. High-velocity flows carrying boulders, gravels, and woody debris progressively abrade gabion wire, spall concrete faces, and introduce thermal stress cycles through repeated wetting and drying of saturated porous materials. Under a climate trajectory of increasing event frequency, gabion mesh may require inspection and replacement at shorter intervals than the nominal design life, and concrete protection works may develop cracking patterns at a higher rate than baseline maintenance models assume. This is a long-term asset management and operational expenditure impact rather than an acute infrastructure safety issue, but it directly affects the road operator's planning assumptions for the full operational period and reinforces the importance of annual pre-season inspection as a minimum operational maintenance standard.

Drainage Capacity Exceedance and Culvert Blockage - The residual risk of greatest practical operational concern, as identified in Section 7.3.3 and in the independent hydrological expert's mission note, is not hydraulic capacity exceedance in the technical design sense but physical blockage of culvert openings by transported boulders and debris during high-energy events. Climate-amplified debris flow events can transport material capable of blocking clear-span openings of 1–2 m within minutes of peak flow arrival, converting hydraulically adequate structures into capacity-constrained ones and generating overtopping and embankment erosion at a discharge well below the structure's hydraulic rating. The frequency of events large enough to transport such material increases under the projected climate trajectory, shortening the effective interval between blockage-clearing maintenance and the next mobilising event. The highest-risk locations correspond to those identified in the CRA hazard mapping and in Section 7.3.3: the crossing structures at km 0–16, km 30–35, and km 45–50. Drainage capacity impacts also have a water resources dimension: climate-amplified overtopping events increase the risk of uncontrolled surface water reaching irrigation channels and community water sources adjacent to the road, connecting drainage infrastructure performance to the water supply impacts described in Section 7.4.3.

Long-Term Hydrological Context for Water Quality and River Morphology - Climate change does not introduce new operational-phase water quality impacts beyond those already assessed as low under Section 7.4 for the rehabilitated road. However, the broader hydrological context is relevant to long-term asset management: the progressive intensification of flood and debris flow events will continue to deliver high sediment and boulder loads to the river system throughout the operational period, maintaining the geomorphological dynamism of the Shurobdaryo that makes embankment protection maintenance a permanent operational requirement. The five-yearly hydraulic and hydrology review recommended in the CRA and reflected in the monitoring programme for this section provides the mechanism for reassessing whether design headroom remains adequate as updated climate projections become available.



7.6.4. Impact Summary and Assessment of Significance

Table 66 provides an assessment of the significance of potential climate change impacts on the project before implementation of the design responses described in this section. Unlike other impact topics, the pre-mitigation baseline for climate change is the project without climate-proofing measures embedded in the design; the post-mitigation position reflects the design with those measures incorporated. Phase C+O indicates impacts relevant to both construction and operational phases.

Hydrological impacts that are amplified by climate change — including intensified construction-phase sedimentation, elevated risk of irrigation and water supply disruption during extreme rainfall events, and increased probability of hydrocarbon spills reaching watercourses — are assessed in full in Section 7.4; they are not duplicated here, but the climate change overlay to those impacts is discussed in the Potential Impacts section above.

Table 66: Impacts and Significance – Climate Change

Phase	Climate Change Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Design Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C+O	Intensification of flooding and debris flows — increased frequency and magnitude of peak discharge events threatening embankments, bridges, and culverts	Road infrastructure; workers during construction in floodplain; road users; communities dependent on corridor access	H	H	H	H	MAJ	LT	INT	H	DEF	H
C+O	Increased landslide and rockfall triggering — higher intensity short-duration rainfall events destabilising slopes above alignment	Road infrastructure; workers at cut slopes during construction; communities in valley below hazard slopes	H	H	H	H	MAJ	LT	INT	H	DEF	H

Phase	Climate Change Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Design Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
O	Pavement deterioration from extreme heat — asphalt rutting and softening under maximum daily temperatures exceeding 45–50°C	Road surface; road users; maintenance operator	M	M	M	M	MOD	LT	INT	M	DEF	M
O	Accelerated material degradation — increased sediment abrasion of gabion mesh and concrete from climate-amplified debris flows; thermal stress cracking in concrete protection works	River embankment protection works; bridges; culverts	H	H	M	M	MOD	LT	INT	M	DEF	M
O	Drainage capacity exceedance — increased peak daily rainfall intensity overloading culverts and drainage structures designed to	Road infrastructure; embankments; downstream communities	H	H	H	H	MAJ	LT	INT	H	POSS	H

Phase	Climate Change Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Design Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	historical standards											
C	Construction disruption — climate-amplified extreme rainfall increasing frequency of stop-work events during construction phase	Construction workers; programme and cost; contract completion	M	M	M	M	MOD	ST	INT	M	DEF	M

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minor / LT: Long term / MT: Medium Term / ST: Short term / SMA: Small / INT: Intermediate / EXT: Extensive / DEF: Definitely / POSS: Possible / UNLIKE: Unlikely. Phase: C = Construction; O = Operation.



7.6.5. Mitigation and Management Measures

Climate Change Adaptation Measures Embedded in the Design

The CRA recommendations have been translated into project design and specification as follows. These are design-level adaptation measures and are not subject to further mitigation by the Contractor; the Contractor's obligation is to construct to the specified design parameters without substitution. Construction-phase management of climate-amplified hazard risk — including seasonal scheduling to avoid peak flood periods, rainfall stop-work triggers by work type, flood emergency response procedures, and on-site weather monitoring — is addressed in full in Section 7.3.5 (Natural Hazards) and Section 7.4.5 (Hydrology) and is not duplicated here.

Hydraulic Design Conservatism — All bridges and culverts have been designed to SNiP 2.05.03-84 return period standards using a 100-year observed daily rainfall input — exceeding the mandatory 33–50 year design standard. The two-step calculation methodology (non-linear runoff formula plus debris flow multipliers of 2.6–4.8) produces design flows primarily determined by catchment physical characteristics rather than the rainfall input, providing inherent resilience against climate-amplified precipitation within the plausible projection range for this region.

Piled Bridge Foundations — All bridge structures have been specified with piled foundations, designed to resist scour, lateral channel migration, and seismic loading. Geotechnical surveys were conducted in accordance with SNiP 11.02-96, with boreholes drilled at each bridge crossing and at retaining wall sections. Actual pile depths at individual locations are subject to confirmation against ground conditions encountered during construction, and no foundation works shall commence without written Engineer sign-off on verified founding conditions, as described in the Soils and Geology section.

Slope Protection and Benching — Slope benching at sections with high and steep gradients has been incorporated into the design as a specific CRA adaptation measure, with dedicated specification coverage under Technical Specification Section 2400 (Slope Protection and Erosion Control) and corresponding BOQ items. Benching reduces the effective slope angle, intercepts runoff, and reduces the surface area available for rainfall-triggered shallow sliding — directly addressing the CRA finding that increased heavy rainfall intensity will decrease slope stability at steeper sections of the corridor. The cost of additional earthworks for benching has been accounted for in the construction cost estimates.

Polymer-Modified Bitumen (PMB) — The CRA identified projected maximum daily temperatures exceeding 45–50°C at the 100-year return period as a material risk to conventional asphalt pavement performance. In response, polymer-modified bitumen has been confirmed for inclusion in the wearing course asphalt specification. PMB improves resistance to rutting and softening at high road surface temperatures and is already in use on roads in Tajikistan. PMB cost is included in the construction cost estimates.

River Training and Engineering Works — Spur dikes, groynes, and river channel regulation works have been included in the design at high-risk embankment sections and are covered by dedicated Technical Specification Section 2100 (River Training and River Channel Regulation Works) with corresponding BOQ items in Bill No. 3. These measures are particularly important around km 4, where documented washouts demonstrate the consequence of unconstrained high-velocity flow impingement on the embankment face. River engineering works actively direct flow away from the embankment toward the centre of the channel, providing a level of protection that embankment-face revetment alone cannot achieve. The design specifies a series of spur dikes at regular intervals upstream of the most exposed sections.

Material Performance Specifications — Gabion mesh, concrete mix designs, and riprap sizing have been specified to meet the material performance requirements of the corridor's aggressive climate



environment, including elevated sediment abrasion loads under climate-amplified debris flows, thermal cycling, and peak temperatures.

Maintenance and Institutional Adaptation — The CRA recommends increasing maintenance contingency budgets at climate-change-vulnerable locations and developing early warning systems to anticipate extreme events. These non-structural measures are addressed in the Operational Management Plan (Section 9 of the ESMP) and in the institutional strengthening component of the project, which includes training of PIURR staff on climate adaptation for road assets. The monitoring programme in this section implements the early warning function for the operational phase.

7.6.6. Residual Impacts

Table 67 assesses residual climate change impacts following implementation of the adaptation measures embedded in the design. The residual significance reflects the irreducible uncertainty in long-term climate trajectories and the possibility of events exceeding design assumptions over a 20–25 year operational life; it does not indicate design failure.

Table 67: Residual Impacts – Climate Change

Phase	Climate Change Impact	Pre-Mitigation Significance	Residual Impact	Residual Impact Significance
C+O	Intensification of flooding and debris flows	High	Design conservatism through debris flow multipliers and observed rainfall inputs provides meaningful headroom against plausible climate uplifts. Residual risk reflects irreducible uncertainty in long-term climate trajectories and the possibility of events exceeding the design return period. Annual inspection and maintenance are required to sustain the Low–Medium rating.	Low – Medium
C+O	Increased landslide and rockfall triggering	High	Engineered slopes are designed and protected to specification. Residual risk lies with naturally unstable slopes above the alignment that cannot be designed out, particularly under increasingly intense rainfall.	Low – Medium
O	Pavement deterioration from extreme heat	Medium	PMB specification substantially improves high-temperature performance. Residual deterioration will require enhanced maintenance frequency relative to a temperate baseline.	Low
O	Accelerated material degradation	Medium	Material specifications are suited to the corridor's aggressive environment. Residual degradation is inherent to mountain river infrastructure and is managed through the maintenance regime.	Low
O	Drainage capacity exceedance	High	The principal residual risk is physical blockage by transported boulders and debris rather than hydraulic capacity exceedance. Maintenance provisions and clear-span structures at exposed crossings are the key remaining controls.	Low – Medium

Phase	Climate Change Impact	Pre-Mitigation Significance	Residual Impact	Residual Impact Significance
C	Construction disruption from extreme rainfall	Medium	Residual programme disruption during peak rainfall periods is inherent to construction in this environment and is accounted for in the construction programme.	Low

7.6.7. Monitoring

Table 68 summarises the climate-specific monitoring requirements. Several items overlap with and reinforce the monitoring programmes described in the Natural Hazards and Water Resources sections; cross-references are noted.

Table 68: Monitoring – Climate Change

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Notes
Construction Phase					
Rainfall monitoring against stop-work triggers	Daily rainfall (mm/day and mm/hr) against defined thresholds by work type	Daily throughout construction; continuous monitoring during rainy season	On-site weather station or verified meteorological service	Contractor (ESHS Manager)	Daily log submitted to Engineer. Stop-work trigger levels defined in CESMP for earthworks, in-river works, slope works, and blasting. Pre-season emergency equipment review before each rainy season. See also Natural Hazards monitoring table.
Pavement surface temperature	Road surface temperature; comparison to PMB specification limits	Periodically during peak summer months; following any reported rutting or deformation	Representative pavement sections throughout corridor	Contractor (ESHS Manager / Works Supervisor)	Infrared thermometer. Any rutting or deformation during construction reported to Engineer immediately for investigation of bitumen specification compliance.
Operational Phase					
Post-event infrastructure inspection	Condition of bridges, embankments, culverts, gabion protection, and slope protection following flood,	After each significant flood event; minimum annually before rainy season	All bridges, major culverts, embankment protection works, and slopes along 56 km corridor	PIURR / Road Operator	Standard inspection protocol. Priority repair programme issued before each rainy season. Consistent with monitoring in Natural Hazards section.

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Notes
	landslide, or seismic events				
Climate and hydrology review	Review of updated climate projections (NEX-GDDP or equivalent) and observed hydrological data against design assumptions; assessment of whether design headroom remains adequate	Every 5 years, or following any flood event exceeding the design return period	Corridor-wide review; focus on hydraulic structures and most exposed embankment sections	PIURR / Road Operator (with specialist input)	Desk review of updated regional climate model outputs against design rainfall inputs and debris flow multipliers. Report with adaptive maintenance recommendations if design conservatism is assessed as materially eroded. Consistent with monitoring in Natural Hazards section.
Pavement condition and rutting	Pavement rutting depth; cracking; surface integrity; assessment against PMB design specification	Annually as part of road condition survey	Full 56 km corridor; priority at south-facing and valley-bottom sections with highest temperature exposure	PIURR / Road Operator	Standard pavement condition survey (IRI, rutting depth). If rutting exceeds acceptable limits during the first five years, investigate bitumen specification performance under recorded temperature data.
Drainage structure blockage	Visual inspection for blockage of culvert openings, silt accumulation, and debris build-up	Annually pre-rainy season; after any significant flood or debris flow event	All culverts and drainage structures along corridor; priority to clear-span structures at highest-exposure crossings	PIURR / Road Operator	Visual inspection register. Any blockage cleared before rainy season. Priority to structures at locations mapped as high flood risk in the CRA (km 0–16, 30–35, 45–50).

7.7. Soils and Geology

The BSK corridor traverses steep mountain terrain underlain by weathered and geomorphologically active geological materials. The combination of thin, productive soils, unstable slope geology, and an active river system means that soil and geological impacts are closely intertwined with the natural hazards and water quality issues addressed in the preceding sections. The principal concerns for this topic are the management of earthworks material, the protection of productive topsoil, the stability of cut slopes and constructed embankments, and the responsible operation, management, and reinstatement of borrow areas. The detailed requirements are set out in the Materials, Spoil and Borrow Area Management Plan (Annex 6 of the Project ESMP) and the Erosion and Sediment Control Plan (Annex 15 of the Project ESMP).

7.7.1. Project Activities with Potential to result in impacts to soils and geology

The following project activities have the potential to affect soils and geology:



- Earthworks, cut and fill, and embankment construction along the 56 km corridor — exposing and disturbing soils and creating new slope geometries that require stabilisation.
- Topsoil stripping at all areas of ground disturbance — creating a requirement to manage and protect topsoil for reinstatement.
- Operation of borrow areas and quarries for extraction of fill material and aggregate — involving land clearance, extraction, and the requirement for progressive reinstatement.
- Spoil disposal from cut sections and unsuitable excavated material — requiring approved disposal sites on geotechnically stable, non-sensitive land.
- Slope protection and riverbank protection works — modifying existing slope geometries and requiring construction of new engineered embankments and retaining structures.
- Operation of construction camps, asphalt plants, crusher facilities, fuel storage areas, and vehicle maintenance areas — presenting risk of soil contamination from spills of fuel, oil, bitumen, chemicals, and concrete washwater.

7.7.2. Sensitive Receptors

The key sensitive receptors for soil and geological impacts are:

- Agricultural soils — irrigated arable land and orchards in the Shurobdaryo valley are among the most productive land in the region and represent a critical livelihood resource for communities along the corridor. Any permanent loss of topsoil fertility or conversion of agricultural land to non-agricultural use has direct food security and livelihood consequences.
- Cut slopes and embankments — both the natural slopes above the alignment and the engineered road embankments are sensitive to destabilisation. Given the steep terrain, the consequences of slope or embankment failure extend beyond the road itself to agricultural land, communities, and the river system below.
- Spoil disposal site neighbours — communities and land users adjacent to spoil disposal sites are sensitive to instability, run-off, and the dust and noise associated with disposal operations.
- The Shurobdaryo — as described in the Water Resources section, the river is sensitive to sediment inputs from eroding slopes and poorly managed spoil sites, both of which represent a soils-pathway impact on water quality.

7.7.3. Potential Impacts

Construction Phase

Soil Erosion - The BSK corridor traverses steep slopes with shallow, erodible soils. Large-scale earthworks will expose significant areas of bare mineral soil on cut faces, embankment slopes, and temporary works areas. In this setting, where intense spring and summer rainfall events generate high-energy runoff with short concentration times, exposed soil surfaces are highly vulnerable to sheet wash, rill formation, and gully erosion. Without effective controls, eroded material will travel rapidly downslope to the Shurobdaryo and its tributaries — a pathway with direct implications for both agricultural productivity and aquatic habitat quality, as described in the Water Resources and Biodiversity sections. The risk is elevated during the spring snowmelt period when soils are saturated and surface runoff is at its maximum.

Topsoil Loss and Degradation - Topsoil in the mountain valley setting is thin, slow to form, and represents decades or centuries of biological activity. Once mixed with subgrade material or buried under spoil, it cannot be practically recovered or replaced. The risk of permanent topsoil loss arises from: failure to strip topsoil separately before excavation commences; mixing of stripped topsoil with subgrade; stockpiling topsoil at excessive heights or in waterlogged conditions that cause anaerobic



degradation; and disposal of topsoil as waste material rather than retaining it for reinstatement. Any of these failures at borrow areas, temporary works areas, or spoil sites will result in a permanent reduction in the productivity of reinstated land.

Slope Instability and Embankment Failure – There is documented failure at km 4, caused by concentrated flow directed perpendicular to the embankment face combined with inadequate cross-drainage. This real-world failure illustrates the principal risk mechanism for this topic: not the weakness of embankment fill material, but the hydraulic loading imposed on embankment faces by poorly managed surface water. Inadequate cross-drainage allows water to pond against embankment faces, generating hydrostatic uplift pressure beneath protective concrete slabs and saturating the embankment core. Under these conditions even well-constructed embankments can fail progressively. The risk is amplified by the projected intensification of extreme precipitation under climate change.

Cut slope instability presents a different but related risk. Over-steepened cut faces in weathered geological materials will undergo progressive ravelling and shallow sliding, particularly following rainfall or freeze-thaw cycles. Where cut slopes are above agricultural land or communities in the valley, the consequences of uncontrolled slope failure extend well beyond the road itself.

Uncontrolled Spoil Disposal - The earthworks programme will generate significant volumes of surplus cut material, including material classified as unsuitable for use as structural fill. If not managed through an approved disposal plan, there is a strong historical tendency on road construction projects in similar settings for spoil to be tipped over the nearest convenient slope edge, into river channels, or onto unoccupied land without regard for stability, drainage, or land rights. In this corridor, uncontrolled tipping into the Shurobdaryo or its tributaries would directly impact aquatic habitat and downstream water users. Tipping on unstable slopes can generate secondary mass movements. Disposal on agricultural land without consent causes land rights conflicts and destroys productive capacity.

Borrow Area Operation - The road will require significant volumes of fill material, with river gravel identified as the primary borrow source. Where hard-rock aggregate is required, quarry sources will be used. Borrow area operation involves land clearance, vegetation removal, extraction, and haulage — all of which generate local environmental and social impacts including dust, noise, erosion, and potential land conflict if sites are not properly authorised. The specific locations of borrow areas are to be confirmed post-award, but the selection criteria and operational controls in Annex 6 of the Project ESMP — including minimum setbacks from watercourses, settlements, cultural heritage sites, and sensitive habitats — are mandatory regardless of the sources ultimately chosen. Borrow areas that are extracted and then abandoned without reinstatement leave scarred landscapes, standing water hazards, and degraded land that may remain unproductive for decades.

Soil Contamination - Fuel, oil, bitumen, chemical, and concrete spills at work fronts, camps, and maintenance areas present a risk of soil contamination. In most cases contamination from isolated spills will be localised and manageable through prompt clean-up. The greater concern is chronic, low-level contamination from poorly managed maintenance areas, inadequate fuel storage bunding, and vehicle washing on unsurfaced ground — the cumulative effect of which can render areas of soil unsuitable for agricultural reuse. Any excavation into previously developed or contaminated ground (for example, adjacent to existing fuel storage facilities) requires prior visual assessment and, where staining or odour is identified, soil sampling before the material is handled or reused.

Operational Phase

The principal operational soils concern is the long-term integrity of embankment slopes and slope protection works. Without adequate maintenance inspection and prompt repair of erosion damage, protection works can deteriorate progressively — leading to embankment undercutting, loss of surface protection, and ultimately the kind of washout events documented at km 4. Annual pre-rainy-



season inspection of all embankments and slope protection works, with a prioritised repair programme before each flood season, is the primary operational mitigation requirement.

Cumulative and Transboundary Impacts

Agricultural land clearance and associated soil disturbance are ongoing background activities in the Shurobdaryo valley and form part of the established baseline condition. No significant additional cumulative soils impacts are anticipated from the project in combination with other identified activities. No transboundary soils or geology impacts are anticipated.



7.7.4. Impact Summary and Assessment of Significance

Table 69 provides an assessment of the significance of potential soils and geology impacts before implementation of the proposed mitigation measures.

Table 69: Impacts and Significance – Soils and Geology

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
Construction Phase												
C	Soil erosion from cut slopes, embankments, and exposed earthworks areas	Productive agricultural soils adjacent to alignment; Shurobdaryo (via sediment pathway); downstream water users	H	H	M	M	MAJ	ST	INT	M	DEF	M
C	Loss and degradation of topsoil through inappropriate stripping, stockpiling, or mixing with subgrade	Agricultural land at borrow areas, spoil sites, and temporary works areas; long-term soil fertility	M	H	L	L	MOD	LT	SMA	M	DEF	M
C	Slope instability and embankment failure from inadequate cut slope design, poor drainage, or overloading	Road infrastructure; agricultural land below embankments; communities in valley below unstable slopes	H	H	H	H	MAJ	MT	SMA	H	DEF	H
C	Uncontrolled spoil disposal — slope tipping, floodplain disposal, or disposal on agricultural land	Shurobdaryo; agricultural land; communities adjacent to disposal sites	M	H	H	H	MAJ	ST	SMA	H	POSS	H

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	Borrow area and quarry operation — land degradation, unsatisfied material demand, and post-extraction abandonment	Agricultural land and natural habitats at borrow sites; communities adjacent to borrow operations	M	M	M	M	MOD	ST	SMA	M	DEF	M
C	Soil contamination from fuel, oil, chemical, or asphalt spills at work fronts and camps	Soils at work zones, camps, and refuelling areas; groundwater underlying contaminated areas	M	M	L	M	MOD	ST	SMA	M	POSS	M
Operational Phase												
O	Embankment erosion and slope degradation through inadequate maintenance	Road infrastructure; agricultural land; downstream water quality	H	M	L	L	MOD	LT	SMA	M	POSS	L

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minor / LT: Long term / MT: Medium Term / ST: Short term / SMA: Small / INT: Intermediate / EXT: Extensive / DEF: Definitely / POSS: Possible / UNLIKE: Unlikely. Phase: C = Construction; O = Operation.



7.7.5. Mitigation and Management Measures

The detailed mitigation requirements for soils and geology are set out in the Materials, Spoil and Borrow Area Management Plan (Annex 6 of the Project ESMP) and the Erosion and Sediment Control Plan (Annex 15 of the Project ESMP). This section summarises the principal measures by impact type.

Pre-Construction Phase

Before earthworks commence in each section, the Contractor shall prepare a Materials Balance Plan quantifying estimated cut volumes by material classification, fill demand, and the resulting net surplus requiring disposal and net deficit requiring external borrow. Maximising direct reuse of cut material as fill, and thereby minimising both external borrow and spoil disposal volumes, is the primary earthworks material strategy. All proposed borrow areas shall be assessed against the siting criteria in Annex 6 of the Project ESMP and approved by the Engineer before extraction commences; extraction licences under the Law on Mineral Resources (1994) and land use authorisations shall be in place before any site opens. All spoil disposal sites shall similarly be approved by the Engineer before use, with absolute exclusions for the river corridor, slopes exceeding 30°, land within 500 m of any settlement, school, or health facility, and agricultural land without documented landowner consent and an agreed reinstatement plan.

Construction Phase

Soil Erosion — The principal erosion controls are set out in Annex 15 of the Project ESMP and mirror those described in the Water Resources section: staged earthworks minimising simultaneously exposed soil area, progressive re-vegetation of completed earthwork sections, pre-season covering or seeding of all exposed slopes and stockpiles before the spring snowmelt, and rainfall-triggered stop-work protocols. Cut-off drains and slope intercept drains shall be installed before earthworks commence in each section, directing clean upslope runoff around active work areas before it becomes contaminated with excavated material.

Topsoil Management — At all borrow areas, temporary works areas, and road formation zones, topsoil shall be stripped separately to the full depth of the A-horizon before any other excavation commences, and stockpiled in clearly demarcated areas away from subgrade material. Stockpile heights shall not exceed 2 m; vehicle access to stockpile areas shall be physically excluded by barriers to prevent compaction; and stockpiles stored beyond six months shall be monitored for anaerobic conditions and manually aerated where required. All stripped topsoil shall be reused for final reinstatement of borrow areas, spoil sites, and temporary works areas — none shall be disposed of.

Slope Stability and Embankment Construction — Cut slopes at gradients $\geq 30^\circ$ shall not commence without a slope stability assessment approved by the Engineer. Embankments shall be constructed to design specifications with adequate cross-drainage to prevent hydrostatic pressure build-up at the embankment face — the critical lesson from the km 4 failure documented in the baseline. Engineered toe protection (gabions, riprap, or riprap blanket) shall be installed at the base of all embankments adjacent to watercourses. Daily slope and embankment inspection with a rainfall stop-work trigger regime is required throughout the earthworks programme, as described in the Natural Hazards section and Annex 15 of the Project ESMP.

Spoil Disposal — All spoil disposal shall be to Engineer-approved sites listed in the Spoil Disposal Site Register (Annex 6 of the Project ESMP). A per-load spoil tracking register shall be maintained throughout construction recording the origin, volume, material class, and disposal location of every load. Spoil shall be placed in engineered layers not exceeding 500 mm compacted thickness; random tipping is prohibited. Perimeter drainage and toe protection shall be installed progressively as disposal proceeds. Geotechnical stability assessments are required for any site with a total capacity exceeding 5,000 m³. Disposal sites shall be progressively rehabilitated and re-vegetated on completion of each phase rather than waiting until project end.



Borrow Area Operation — Active borrow areas shall be operated within licensed boundaries, with topsoil stripped and segregated before extraction begins, working faces maintained at safe slopes, dust suppression applied to unpaved haul roads, and perimeter drainage established to prevent contaminated runoff reaching watercourses. Progressive reinstatement of completed bays concurrent with active extraction is required — all borrow areas shall be fully reinstated, re-contoured, topsoiled, and re-vegetated before the Contractor demobilises from each site.

Soil Contamination — Contamination prevention measures for fuel, oil, and chemical storage are described in the Water Resources section and set out in Annex 7 of the Project ESMP. Any excavated material displaying visual signs of contamination (staining, odour, unusual discolouration) shall be classified as Class D under the Materials Classification in Annex 6, quarantined on site, and disposed of in accordance with the Waste Management Plan (Annex 5 of the Project ESMP) rather than being reused as fill or deposited at spoil sites.

Operational Phase

The road operator shall implement an annual pre-rainy-season inspection of all embankments and slope protection works, with a prioritised repair programme to address erosion damage, gabion failures, and cross-drainage blockages before the onset of each flood season. Maintenance records shall be retained and submitted to PIURR annually.

7.7.6. Residual Impacts

Table 70 summarises residual soils and geology impacts following implementation of the mitigation measures described above and in the ESMP.

Table 70: Residual Impacts – Soils and Geology

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
C	Soil erosion	Medium	Some erosion on exposed faces during peak rainfall periods is unavoidable given the steep terrain. Effective drainage and early stabilisation will limit its extent and duration.	Low
C	Topsoil loss and degradation	Medium	Separate stripping, dedicated stockpiling, and full reuse for reinstatement will preserve soil fertility. No material residual impact remains.	Not Significant
C	Slope instability and embankment failure	High	Residual risk remains on naturally unstable slopes above the alignment that cannot be designed out. Engineered slopes are managed to specification.	Low
C	Uncontrolled spoil disposal	High	No material residual risk with absolute prohibition on unauthorised disposal and per-load tracking in place.	Not Significant
C	Borrow operation area	Medium	No material residual impact with licensed operations, setback compliance, and progressive reinstatement.	Not Significant

C	Soil contamination	Medium	No material residual risk with bunded storage, designated maintenance areas, and spill response controls in place.	Not Significant
O	Embankment erosion through inadequate maintenance	Low	Residual erosion is inherent to mountain road operation and managed through the maintenance inspection regime.	Low

7.7.7. Monitoring

Table 71 summarises the soils and geology monitoring requirements. Observational monitoring per the ESMP is the primary approach; instrumental soil quality testing is only required where visual inspection identifies potential contamination during excavation.

Table 71: Monitoring – Soils and Geology

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Equipment
Construction Phase					
Cut slope and embankment inspection	Visual assessment of slope stability, erosion, tension cracking, seepage, and effectiveness of protection measures	Daily at all active cut slopes and embankments; after any rainfall ≥ 10 mm; after any blasting or seismic event	All cut slopes $\geq 30^\circ$ gradient and all constructed embankments along 56 km corridor	Contractor (Environmental Inspector)	Standardised inspection log with photographic record (Annex 15 of the ESMP). Stop-work if instability signs identified. Monthly report to Engineer.
Topsoil stockpile management	Segregation of topsoil from subgrade; stockpile height (max 2 m); erosion protection; aeration condition if stored >6 months	Daily during stripping and stockpiling operations; weekly stockpile checks throughout storage period	All topsoil stockpiles at borrow areas, road formation, and temporary works areas	Contractor (Environmental Inspector)	Visual inspection log; photographic record. Segregation confirmation photos at stripping. Aeration records if stockpile exceeds 6 months. Final placement records on reinstatement.
Spoil disposal site inspection	Compliance with approved disposal site locations; slope stability of placed spoil; absence of tipping into river corridor, onto slopes $>30^\circ$, or onto agricultural land; progressive reinstatement status	Daily during active disposal; weekly stability inspection of all active spoil sites; after any rainfall ≥ 10 mm	All approved spoil disposal sites (Spoil Disposal Site Register, Annex 6 of the ESMP)	Contractor (Environmental Inspector); Engineer verification	Per-load spoil tracking register (origin, volume, disposal site). Weekly inspection log with photos. Engineer sign-off on site closure and final reinstatement. Zero unapproved disposal incidents.

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Equipment
Borrow area compliance	Operation within licensed area boundaries; topsoil stripping and storage; face slopes within safe limits; progressive reinstatement; compliance with siting criteria	Daily during active extraction; monthly formal audit against Borrow Area Register	All active borrow areas (Borrow Area Register, Annex 6 of the ESMP)	Contractor (ESHS Manager / Environmental Inspector); Engineer verification	Inspection log and photographic record. Extraction licence copies on file. Volume records updated monthly. Engineer sign-off required for site closure and final reinstatement.
Soil contamination — visual inspection	Visual signs of hydrocarbon or chemical contamination at work fronts, camps, refuelling areas, and excavation faces; any unusual staining, odour, or discolouration in excavated material	Daily at all work fronts, camps, and fuel storage areas; whenever excavation enters previously developed or industrial ground	All fuel storage areas, vehicle maintenance areas, and excavation faces along corridor	Contractor (Environmental Inspector / Site Supervisors)	Visual inspection log. Any suspected contaminated material classified as Class D (Annex 6 of the ESMP) and quarantined pending ESHS Manager assessment. Notify Engineer immediately.
Operational Phase					
Embankment and slope protection condition	Erosion of embankment faces; integrity of slope protection works (gabions, riprap, stone pitching); signs of settlement or instability	Annually before the rainy season; after any significant flood, landslide, or seismic event	All road embankments and slope protection works along 56 km corridor; priority to sections with documented previous failures (e.g. km 4)	PIURR / Road Operator	Standard road inspection record. Priority repair programme issued before each rainy season. Annual inspection report to PIURR.

7.8. Noise and Vibration

7.8.1. Project Activities with Potential to result in noise and vibration impacts

During the construction phase, noise and vibration impacts can arise from multiple activities, including:

- Operation of plant and stationary equipment — asphalt plant, crushers, screening plant, diesel generators, concrete batching plant, and compressors.
- Movement and operation of construction vehicles, including excavators, bulldozers, graders, rollers, dump trucks, and water bowsers, throughout the full 56 km corridor.



- Earthworks including bulk cut and fill, embankment construction, and slope re-profiling.
- Rock-breaking and mechanical excavation in hard-rock cut sections.
- Blasting in rock cut sections, where required.
- Piling and foundation works at bridge structures.
- Bridge construction and demolition of existing structures.

During the operational phase, movement of vehicles along the rehabilitated road will generate noise and low-level vibration. However, the rehabilitation and paving of currently unpaved sections is expected to reduce rolling noise and road-surface vibration in comparison to the existing rough, unmaintained surface, representing a beneficial change for many adjacent communities.

With respect to vibration, available evidence indicates that road traffic-induced vibration is typically well below levels associated with structural damage to buildings. Guidance from the World Health Organization notes that vibration from road traffic is generally of low magnitude and more relevant to human perception (annoyance) than to structural effects. Similarly, the Federal Transit Administration Transit Noise and Vibration Impact Assessment Manual identifies road traffic as a minor source of ground-borne vibration, with damage thresholds for buildings (e.g. as defined in DIN 4150-3) typically far exceeding vibration levels generated by normal road operations.

On this basis, and in the absence of heavy industrial sources or abnormal loading conditions, no evidence has been identified to suggest that operational road traffic under normal conditions results in structural damage to adjacent properties, although perceptible vibration may occasionally occur in close proximity to the carriageway, particularly where heavy vehicles are present.

7.8.2. Sensitive Receptors

Residents living adjacent to the corridor are the primary noise-sensitive receptors. The narrow mountain valley setting of the BSK corridor means that many of the settlements along the 56 km alignment are located immediately adjacent to the road with minimal separation distance. The confined valley geometry, with hard rock faces on both sides, can amplify and reflect sound in ways that are atypical of open terrain, meaning noise from construction activities may travel further and be more intrusive than on a comparable project in open country.

Schools, medical facilities, mosques, and cemeteries are present along the corridor and constitute sensitive receptors of elevated concern. Working hours restrictions near these receptors are more conservative than for general residential areas.

The Bukhara deer breeding farm at Dashtaro village is also a sensitive receptor. Captive Bukhara deer (*Cervus hanglu bactrianus*, a Red Book species) are highly sensitive to sudden loud noise and vibration, particularly during the breeding and calving season. This receptor requires site-specific noise and vibration controls that go beyond standard residential thresholds, and is addressed separately in the Biodiversity Management Framework (Annex 8 of the ESMP) and in the Noise and Vibration Management Plan (Annex 14 of the ESMP).

Livestock more generally may be present in fields and on tracks adjacent to works and are sensitive to sudden high-noise events such as blasting.

The baseline acoustic environment along the corridor is generally quiet, reflecting low traffic volumes and the rural, agricultural character of the valley. The existing unpaved road surface does generate dust and roughness-related noise under traffic, but background noise levels are low by comparison with peri-urban or industrial baselines. This low background means that construction noise will be audible at settlements from a greater distance than on a higher-noise baseline, and that community sensitivity to noise impacts is likely to be correspondingly higher.

7.8.3. Potential Impacts

Construction Phase — Noise

Construction Equipment Noise — Noise during the construction phase will predominantly arise from the operation of heavy construction plant and equipment. Typical noise levels at the source for the main equipment types that will be deployed on the BSK project are shown in Table 72.

Table 72: Typical Noise Levels

Equipment	Typical Noise Level at Source (dB(A))	Activity
Earthworks and Excavation		
Excavator / Backhoe	72–93	Bulk excavation, cut and fill
Bulldozer	80	Topsoil stripping, embankment formation
Dump Truck	83–94	Material haulage on haul roads
Grader	80–93	Surface grading, earthworks formation
Vibratory Roller	73–75	Embankment and sub-base compaction
Pavement and Structure Works		
Paver	86–88	Asphalt laying
Pneumatic Drill / Jack Hammer	81–98	Rock breaking, concrete demolition
Concrete Mixer	74–88	Concrete production at structure sites
Air Compressor	74–87	Pneumatic tool supply
Plants and Generators		
Diesel Generator	72–82	Power supply at camps and work fronts
Crusher / Screening Plant	75–90	Aggregate production at quarry/borrow
Asphalt Plant	75–85	Asphalt mixing and production

Assuming three items of heavy plant operating concurrently at a single work front — for example, an excavator, a dump truck, and a bulldozer — and combining their maximum source noise levels, a combined noise level of approximately 96–97 dB(A) would be generated at the work zone. At a distance of 20 m from the works, this corresponds to approximately 68–70 dB(A). This exceeds the applicable daytime limit at residential receptors of 55 dB(A) LAeq and is generally above ambient noise levels in the quiet valley setting. Construction activities will be transient — works will progress along the corridor and the period of elevated noise at any given settlement will be measured in days to weeks rather than months.

Crusher and Asphalt Plant Noise — The crusher and asphalt plant are stationary, prolonged noise sources that will operate for extended periods at fixed locations. Unlike earthworks noise, the impact from these facilities will be sustained at the nearest settlement for as long as the facility is operational. At a separation distance of 500 m from the nearest settlement boundary, source noise levels from a crusher (approximately 85 dB(A)) would attenuate to approximately 59 dB(A) in open terrain — marginally above the 55 dB(A) daytime limit.

Construction Phase — Blasting

Where rock excavation is required, blasting may be necessary. Blasting is the highest instantaneous noise and vibration source on the Project and requires specific management separate from general construction noise. Blasting events generate impulsive noise levels that can significantly exceed background levels at distances of several hundred metres, as well as ground vibration that propagates to structures within 500 m or more of the blast site.

Construction Phase — Vibration



Ground-borne vibration from construction activities is generated primarily by vibratory compaction equipment (rollers), rock-breaking, blasting, and heavy vehicle movements on rough surfaces. Piling at bridge structures will also generate vibration.

A critical issue for the BSK project is that the applicable national standard for construction vibration (SanPiN, 0.5 mm/s PPV at residential buildings) is ten times more stringent than the equivalent DIN 4150-3 threshold (5 mm/s PPV). At the SanPiN limit, routine construction activities including dynamic compaction and vibratory rolling will exceed the standard at distances that make practical standoff infeasible on a narrow mountain corridor. Strict application of 0.5 mm/s as an absolute stop-work threshold would effectively prohibit normal earthworks near any structure. The Bukhara deer farm is a particularly sensitive receptor, given the behavioural sensitivity of captive deer, and may require a more conservative vibration threshold than that applicable to residential buildings.

Operational Phase — Noise

Measured baseline conditions. Instrumental noise measurements were conducted at six locations along the corridor in July 2023 as part of the IEE baseline surveys. Daytime readings across all six monitoring points ranged from 41.1 to 45.2 dB(A), with a corridor mean of approximately 43.5 dB(A) during peak daytime hours. All points were below the applicable Tajik SanPiN daytime residential limit of 55 dB(A). At current traffic volumes the ambient noise environment is dominated by natural background sources — watercourses, wind, and low-level agricultural activity — rather than road traffic.

Traffic growth assumptions. The IEE records current traffic at approximately 100 vehicles per day (vpd), with an observed historical growth rate of around 10% per year. For this assessment, a two-phase growth model has been adopted which better reflects the likely trajectory of traffic demand on a newly paved mountain corridor.

In the first phase, covering approximately the first seven years after road opening, a growth rate of 20% per year is assumed. This accounts for the significant induced demand expected from the road improvement itself: substantially reduced journey times, year-round access where previously the road was impassable in winter, and the early-stage development of tourism to the Sari-Khosor waterfall and nature park. This phase represents the period of sharpest traffic increase.

In the second phase, from Year 8 onwards, growth is assumed to moderate to approximately 9% per year as the initial induced-demand effect subsides and traffic settles into a longer-run trend driven by population growth, freight activity, and incremental tourism development. This rate is above the IEE's observed historical baseline but below the induced-demand peak, reflecting the realistic economic trajectory of a remote mountain district.

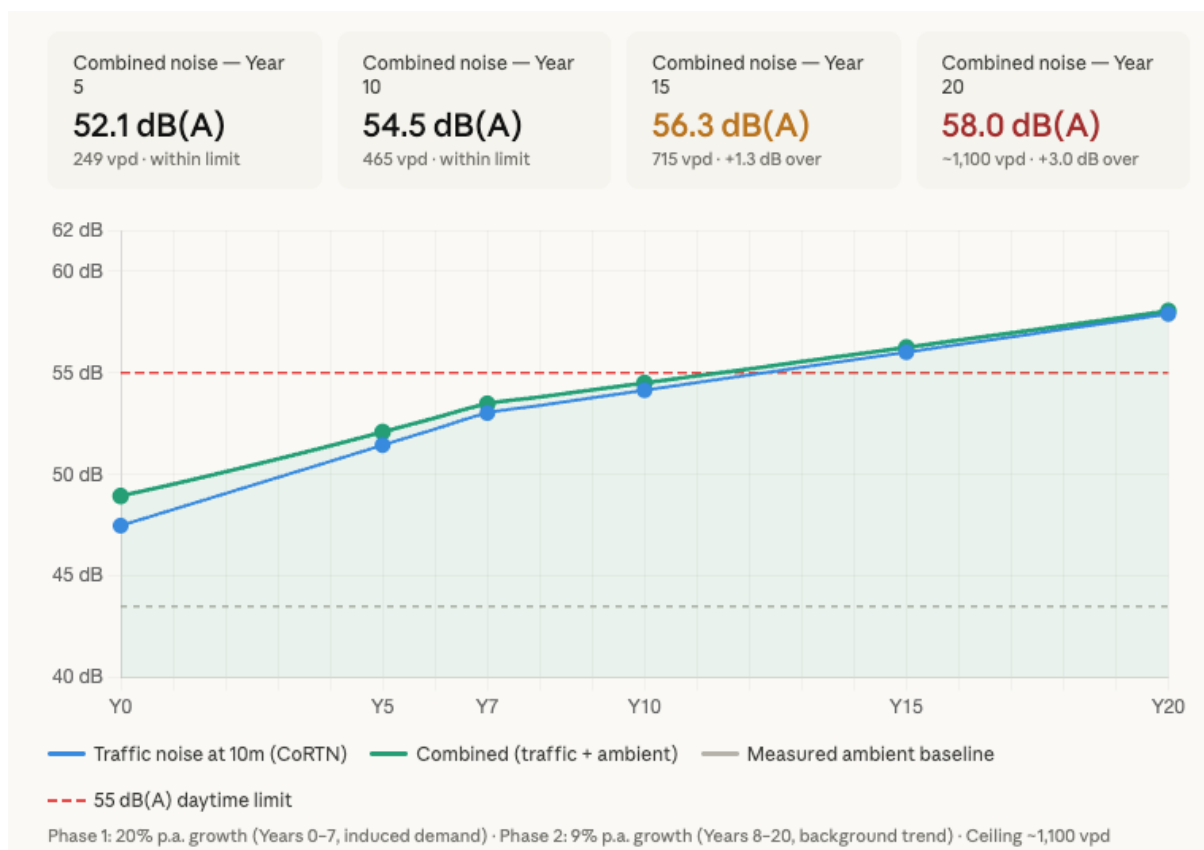
A long-run AADT ceiling of approximately 1,000–1,200 vpd has been applied as a practical upper bound. This figure is consistent with the estimated corridor catchment population of 10,000–20,000 people, prevailing vehicle ownership rates in rural Khatlon region, and the road's Category IV design standard, which is not intended to accommodate significantly higher flows in mountainous terrain. The uncapped 20% compound growth scenario would produce approximately 3,800 vpd by Year 20 — a figure that would be implausible for a corridor of this size and is not considered a credible planning assumption.

Projected noise levels. Road traffic noise at 10 m from the roadside has been estimated using a simplified adaptation of the UK Calculation of Road Traffic Noise (CoRTN) method, at a design speed of 40 km/h. Combined noise levels — accounting for both road traffic and the measured ambient background — were calculated by logarithmic addition. Results are summarised in the table below.

Table 73: Predicted Noise Levels

Year	Approx. AADT (vpd)	Traffic noise at 10 m (dB(A) L_Aeq)	Combined noise: traffic + ambient (dB(A))	Status vs 55 dB(A) limit
Baseline (2023)	100	47.5	49.0	Within limit
Year 5	249	51.4	52.1	Within limit
Year 7 (phase transition)	359	53.0	53.5	Within limit
Year 10	465	54.1	54.5	Within limit (marginal)
Year 12	552	54.9	55.2	Marginally exceeds limit
Year 15	715	56.0	56.3	Exceeds limit by 1.3 dB
Year 20	~1,100	57.9	58.0	Exceeds limit by 3.0 dB

Figure 55: Predicted Noise Levels



Cumulative Impacts

No other major construction projects in the corridor are expected to generate significant cumulative construction noise. The principal cumulative noise effect during construction will be the extended duration of construction activities as works progress along the 56 km corridor — individual



settlements will experience elevated noise for a period of weeks, but not the multi-year continuous exposure that would arise from a simultaneously active large construction site.

Transboundary Impacts

All construction activities are located within Tajikistan. No transboundary noise or vibration impacts are anticipated.



7.8.4. Impact Summary and Assessment of Significance

Table 74 provides an assessment of the significance of potential noise and vibration impacts before implementation of the proposed mitigation measures. Impact significance is assessed based on the magnitude of the potential impact, the sensitivity of receptors, the spatial scale, timeframe, and probability of the impact occurring.

Table 74: Impacts and Significance – Noise and Vibration

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	Construction equipment noise (earthworks, plant, heavy vehicles)	Communities in 19 settlements along 56 km corridor; schools; clinics; mosques; Bukhara deer farm at Dashtaro	H	M	H	H	MAJ	ST	INT	M	DEF	M
C	Crusher and asphalt plant noise	Nearest settlement to each facility; plant workers	M	M	M	M	MOD	ST	SMA	M	DEF	M
C	Blasting noise (where rock excavation is required)	Communities and structures within 500 m of blast sites; Bukhara deer farm	M	M	H	H	MAJ	ST	SMA	H	POSS	M
C	Construction vibration (vibratory compaction, rock-breaking, piling)	Structures within 100 m of works; Bukhara deer farm	M	M	M	H	MAJ	ST	SMA	M	DEF	M
C	Blasting vibration (where rock	Buildings within 500 m of blast sites; historic structures;	M	H	H	H	MAJ	ST	SMA	H	POSS	M



Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	excavation is required)	Bukhara deer farm										
O	Operational traffic noise	Communities in settlements adjacent to road	H	L	M	M	MOD	LT	INT	M	DEF	M

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minor / LT: Long term / MT: Medium Term / ST: Short term / SMA: Small / INT: Intermediate / EXT: Extensive / DEF: Definitely / POSS: Possible / UNLIKE: Unlikely. Phase: C = Construction; O = Operation.



7.8.5. Mitigation and Management Measures

Pre-Construction Phase

Noise and Vibration Management Planning — The Contractor shall, as part of the CESMP, prepare and implement a Noise and Vibration Management Plan (NVMP) in accordance with the framework provided in Annex 14 of this ESMP. The NVMP shall be completed with site-specific details — including the sensitive receptor register with GPS coordinates and distances, baseline monitoring results, agreed working hours for each settlement, blasting management procedures (where applicable), and monitoring station locations — before construction works commence near any settlement. The Plan shall be submitted to the Engineer for approval.

Pre-Construction Baseline Noise Monitoring — The Contractor's Environmental Inspector shall conduct 24-hour ambient noise measurements at representative receptor locations in each settlement area and at the Bukhara deer farm boundary before construction commences in that area. Baseline measurements shall be conducted using a Type 2 or better integrating sound level meter, calibrated in accordance with the manufacturer's specification. Baseline data shall be reported to the Engineer and shall inform the interpretation of construction-phase monitoring results.

Pre-Construction Structural Condition Surveys — Not later than 28 days before commencement of any vibration-generating works, the Contractor and Engineer shall complete joint condition surveys of all buildings within 50 m of the road alignment at blast locations, and within 20 m for all other vibration. Surveys shall be carried out in the presence of and with the agreement of the property owners. The survey record shall include the building address and location; a description of existing condition including any pre-existing cosmetic or structural damage; photographs and sketches; high-resolution video recording; and verification by the building owner. These records serve as the reference baseline for any claims of vibration damage through the Grievance Redress Mechanism.

Bukhara Deer Farm — Pre-Works Agreement — Before any works commence within the construction noise influence distance of the Bukhara deer farm, the Contractor's Ecologist shall establish agreed noise and vibration thresholds with the Farm Manager. These thresholds shall reflect the specific behavioural sensitivity of the captive Bukhara deer and shall be confirmed in writing. Working restrictions during the calving season — including a prohibition on blasting within the agreed standoff distance — shall be confirmed in coordination with the Farm Manager and recorded in the NVMP.

Construction Phase — Noise Controls

Source Controls — All construction plant and equipment shall be maintained in good working condition in accordance with manufacturer specifications, and any defective silencers, exhausts, or engine housings shall be repaired before equipment is deployed near any settlement. Equipment with lower noise emission ratings shall be selected in preference to noisier alternatives where a realistic choice exists. Reversing alarms on vehicles operating within 200 m of residential areas shall use broadband ('white noise') type alarms rather than tonal beepers where available, to reduce sleep disturbance. Pneumatic breakers shall be fitted with acoustic shrouds where operating within 150 m of any sensitive receptor. Compressors and generators shall be housed in acoustic enclosures or positioned behind solid barriers when operating within 300 m of any settlement. Impact piling shall not be used within 200 m of any occupied structure; bored or vibratory piling shall be used as alternatives where geotechnical conditions permit.

Permitted Working Hours Near Settlements — General construction works are permitted between 07:00 and 19:00, Monday to Saturday. High-noise activities — including rock-breaking, piling, blasting, and vibratory compaction — are further restricted to 08:00–17:00, Monday to Saturday. Night works involving any activity within 300 m of a settlement are not permitted without specific written Engineer approval, advance community notification, and noise monitoring. No high-noise construction activity shall be undertaken during Friday prayers at locations within audible range of a mosque, where the community or local authority requests this restriction.



The applicable noise limit at schools, clinics, and mosques during hours of use is 50 dB(A) LAeq,1h — 5 dB more stringent than the residential daytime limit of 55 dB(A). Working hours restrictions near these receptors are correspondingly more conservative than for general residential areas

Temporary Noise Barriers — Where sustained high-noise works — such as rock-breaking, piling, or concrete demolition — are required within 100 m of a sensitive receptor, temporary acoustic barriers of at least 2.4 m in height, of solid construction with no gaps, shall be erected between the noise source and the receptor. Earthen bunds or stockpiles may be used as supplementary screening where site layout permits, and barrier effectiveness shall be verified by noise measurement at the receptor during the first day of operation.

Asphalt Plant and Crusher — Both the asphalt plant and the crusher shall be sited a minimum of 500 m from the boundary of the nearest settlement, with siting decisions accounting for prevailing wind direction and topographic sound channelling. Continuous noise sources at these plants — including fans, conveyors, and motors — shall be fitted with acoustic enclosures or silencers where available. Night-time operation of either facility within 500 m of any settlement is prohibited without prior Engineer approval and community notification.

Community Communication — The SCLO shall notify each settlement at least 48 hours before the start of high-noise works in their vicinity, including rock-breaking, blasting, piling, and heavy earthmoving. Notification shall cover the nature of the works, expected duration, daily working hours, measures being taken to minimise noise, and the contact for complaints. Where sustained high-noise works will last more than two weeks adjacent to a settlement, the SCLO shall hold a community briefing at the start and provide weekly updates on progress and expected completion. Noise complaints shall be recorded in the Grievance Register and responded to within 24 hours, with the SCLO visiting the complainant in person where the complaint is substantiated.

Construction Phase — Vibration Controls

Compaction and Earthworks — Vibratory rollers and compaction plant operating within 50 m of any occupied structure shall use low-amplitude vibration settings, and the Contractor shall verify through pre-works vibration monitoring that the applicable PPV limit is not exceeded at the nearest structure before full-amplitude compaction proceeds. Static rolling (without vibration) shall be used for compaction immediately adjacent to any structure where required.

Where pre-works assessment demonstrates that the SanPiN 0.5 mm/s PPV target cannot be met at a specific location without rendering compaction works impractical, the Contractor shall document this finding and submit it to the Engineer for approval to apply DIN 4150-3 (5 mm/s PPV) as the operative threshold for that activity and receptor. This approval must be in writing before works proceed, and 5 mm/s PPV remains the absolute backstop in all cases.

Blasting Controls — A Blasting Management Plan shall be prepared by a licensed blasting contractor and approved by the Engineer before any blasting commences anywhere on the project, in accordance with the requirements of Annex 14 of the ESMP. Pre-blast structural condition surveys shall be completed for all buildings within 500 m of any proposed blast site. Trial blasts at reduced charge weights shall be conducted and vibration monitored at the nearest receptor before production blasting begins, with charge weights and delay patterns designed to maintain vibration below the applicable PPV limits. Blasting shall be confined to the daily window of 09:00–16:00 near settlements and shall not occur during Friday prayers within audible range of a mosque. No blasting shall be carried out within the agreed buffer distance of the Bukhara deer farm during the calving season, or at any time in excess of the agreed vibration threshold at the farm boundary, without PIURR approval. All blasting audible warning signals — pre-blast, fire, and all-clear — shall follow the procedure in the Emergency Preparedness and Response Plan (Annex 4 of the ESMP).

Operational Phase



No structural mitigation measures are required at the time of road opening. The projections set out in Section 7.8.3 indicate that the 55 dB(A) daytime residential limit will not be exceeded at the roadside until approximately Year 12 under the two-phase traffic growth model, and the projected exceedance at the design horizon of Year 20 is modest at approximately 3 dB. The appropriate response is therefore a monitoring-led programme with a defined intervention trigger, rather than upfront capital measures.

Operational Noise Monitoring - Annual noise monitoring shall be conducted at the six baseline measurement locations established in the IEE (Table 31) during the first three years of operation, and thereafter at intervals of not more than three years. Monitoring shall use a Type 2 or better integrating sound level meter and shall measure L_{Aeq} over a minimum 60-minute period during the peak daytime traffic hour. Results shall be compared directly against the pre-construction baseline and reported to PIURR in the annual Environmental Monitoring Report.

Intervention Trigger - If monitoring at any settlement location records a sustained daytime L_{Aeq} at the nearest residential receptor at or above the 55 dB(A) limit, PIURR shall designate a 30 km/h speed limit through the affected settlement zone and enforce it by physical traffic calming measures at the entry and exit points of the settlement. This measure shall be implemented within six months of the monitoring result that triggers it. A speed reduction from 40 to 30 km/h through a settlement provides a noise reduction of approximately 2–3 dB(A) at the roadside, which is sufficient to bring levels back within the limit under the projected traffic volumes at which exceedance is first expected to occur.

7.8.6. Residual Impacts

The following table provides an assessment of residual noise and vibration impacts following implementation of the mitigation measures described above.

Table 75: Residual Impacts – Noise and Vibration

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Impact Significance
C	Construction equipment noise	Medium	Temporary daytime-only impacts with brief exceedances possible during intensive earthworks near settlements.	Low
C	Crusher and asphalt plant noise	Medium	No material residual impact at the mandatory 500 m siting distance from settlements.	Not Significant
C	Blasting noise	Medium	Instantaneous events cannot be eliminated but will be infrequent, short-lived, and pre-notified to communities.	Low
C	Construction vibration	Medium	Residual vibration will be within operative limits. DIN 4150-3 applies as the approved backstop where the SanPiN limit is demonstrably unachievable.	Not Significant
C	Blasting vibration	Medium	Charge weight design and monitoring will reduce structural damage risk to a level of no material residual concern. Calving season restriction applies near the Bukhara deer farm.	Not Significant

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Impact Significance
O	Operational traffic noise	Medium	Paving reduces noise at road opening. The 55 dB(A) limit is projected to be marginally exceeded around Year 12, at which point a 30 km/h speed limit through the affected settlement zone will be designated within six months.	Low

7.8.7. Monitoring

Monitoring of noise and vibration impacts shall be undertaken per the Project ESMP monitoring programme. Requirements are summarised in Table 76 below.

Table 76: Monitoring – Noise and Vibration

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Equipment
Construction Phase					
Baseline ambient noise	LAeq (1h), dB(A)	Once, before construction commences in each settlement area	Representative receptor at each of the 19 settlements closest to active works; Bukhara deer farm boundary	Contractor (ESHS Manager)	Type 2 (or better) integrating sound level meter; 24-hour measurement; calibration certificate required. Results reported to Engineer before works begin.
Construction noise — routine	LAeq (1h), dB(A); limit 55 dB(A) daytime / 45 dB(A) night-time at receptor	Weekly during active works within 200 m of any settlement; on commencement of each new high-noise activity	Nearest residential receptor to active high-noise works; schools and clinics within 200 m of works; Bukhara deer farm when works within 500 m	Contractor (Environmental Inspector); Engineer verification	Type 2 integrating SLM, calibrated. Measurements at receptor façade. Any exceedance reported to Engineer within 24 hours with corrective action.
Occupational noise	LAeq (8h TWA), dB(A); limit 85 dB(A) LAeq,8h (IFC/WHO occupational action level)	Initial survey on commencement at high-noise work stations; repeated if task or equipment changes	Workers at crusher, asphalt plant, rock-breaking and blasting operations	Contractor (ESHS Manager / OHS Officer)	Personal noise dosimeter or Type 2 SLM. Records maintained in OHS file.
Construction vibration — earthworks	Peak Particle Velocity (PPV), mm/s. Limits per Annex 14 §3.2: continuous vibration (compaction, piling) — 5 mm/s PPV at	Continuous during vibratory compaction, rock-breaking, piling within 100 m of any occupied structure; during any works within buffer of	Foundation of nearest occupied structure to works; Bukhara deer farm boundary	Contractor (Environmental Inspector)	Triaxial vibration monitor at foundation level; data downloaded and reviewed daily. Stop-work if limit exceeded.

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Equipment
	building foundation; transient vibration (blasting) — 10 mm/s PPV at building foundation; historic or fragile structures and cemeteries — 3 mm/s PPV. National SanPiN target: 0.5 mm/s PPV (apply where practicable; DIN 4150-3 backstop applies where demonstrated unachievable — see §7.8.5)	Bukhara deer farm			
Construction vibration — blasting	PPV mm/s; limits: 10 mm/s transient residential; 3 mm/s historic / fragile structures	Each blast event within 500 m of any structure or the deer farm	Foundation of nearest occupied structure; nearest sensitive receptor; deer farm boundary	Licensed blasting contractor; Engineer verification	Triaxial vibration monitor. Pre-blast structural survey. Results submitted to Engineer within 24 hours of each blast.
Community noise complaints	Number, nature, and location of noise / vibration complaints	Continuous; reviewed weekly	All settlements along corridor	SCLO; ESHS Manager	Grievance Register. Noise complaints responded to within 24 hours. SCLO visits complainant in person where complaint is substantiated.
Operational Phase					
Operational traffic noise	LAeq (1h) daytime, dB(A); limit 55 dB(A) at nearest residential receptor	Annually during the first three years of operation; thereafter at intervals of not more than three years	Baseline monitoring stations at representative settlements; any new complaint locations	PIURR / Road Operator	Type 2 integrating SLM; minimum 60-minute measurement during peak daytime traffic hour. Results compared against IEE baseline and reported in annual Environmental Monitoring Report. If 55 dB(A) is recorded at any location, PIURR to

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Equipment
					initiate speed limit designation within six months.

7.9. Protected Areas

This section assesses the potential impacts of the BSK project on the Sari Khosor Nature Park, the only nationally designated protected area within the project's area of influence that is considered likely to be potentially affected. The Nureksky zakaznik, although noted in the baseline, is scoped out of this section for the reasons set out in Section 7.8.2.

7.9.1. Project Activities with Potential to result in impacts to protected areas

The following project activities are relevant to the Sari Khosor Nature Park:

- Construction activities in the Shurobdaryo catchment — earthworks, in-river works, and fuel and chemical storage along the 56 km corridor all present a pathway for indirect water quality impacts reaching the Nature Park via the river system.
- Construction noise and vibration from work fronts near the Nature Park proximity zone — particularly relevant to the Bukhara deer breeding farm at Dashtaro village, which is supervised by the Nature Park administration and is within construction noise influence distance of the corridor.
- Presence of a construction workforce of potentially several hundred workers in a remote mountain valley previously accessible only by an unsurfaced track — creating increased pressure for illegal hunting, fishing, and wildlife collection within and adjacent to the Nature Park.
- Rehabilitation and paving of the road — improving all-season access to the Sari Khosor area and therefore to the Nature Park, with implications for both legitimate tourism growth and for organised poaching.
- Ancillary facility siting — camps, borrow areas, and spoil sites must be located and managed to ensure no direct or indirect encroachment on the Nature Park or its buffer zone.

7.9.2. Sensitive Receptors

The key sensitive receptors in this section are:

- The Sari Khosor Nature Park — a nationally designated protected area located approximately 5 km from the corridor at its closest point. The Park is not directly disturbed by any project works but falls within the project's induced impact zone for access-related effects. Under the Law on Specially Protected Natural Areas (1994, as amended), activities that damage protected area values or integrity are prohibited; construction within or in the buffer zone of a protected area requires specific authorisation. Documentation received from the CEP did not indicate that the park was located within the buffer zone and that confirmed that “given the 5 km separation, the likelihood of impact on the natural environment of the Park is considered insignificant.”
- The Bukhara deer (*Cervus hanglu*) breeding farm at Dashtaro village — managed under the supervision of the Sari Khosor Nature Park administration. Bukhara deer are listed as Critically Endangered on the IUCN Red List. The farm lies within the construction noise influence distance of the corridor and is a specific sensitive receptor requiring targeted noise and vibration management, particularly during the calving season.



- Wildlife populations within the Nature Park and the wider corridor — including the species and habitats that underpin the Park's protected area designation and those addressed under the Critical Habitat assessment in the Biodiversity section.
- The Nature Park administration — whose management capacity to absorb increased visitor and access pressure following road improvement is a key variable in the long-term significance of the operational access impact.

Scoped-out receptor — Nureksky Zakaznik - The Nureksky zakaznik is a state zakaznik located on the western side of the Vakhsh Range. Although its boundary lies within relatively short straight-line distance of the BSK corridor, the two are separated by a continuous mountain ridgeline with a height differential of over 600 m above the road. There is no road, track, or accessible route connecting the Project alignment to the zakaznik across this ridge. The road improvement will not provide, directly or indirectly, any meaningful increase in human access to the zakaznik. The Project-induced access, poaching, and encroachment risks that are relevant to the Sari Khosor Nature Park are therefore considered negligible in relation to the Nureksky zakaznik. The zakaznik is accordingly scoped out of the detailed impact assessment in this section.

7.9.3. Potential Impacts

Construction Phase

Noise, Vibration, and the Bukhara Deer Farm - The Bukhara deer breeding farm at Dashtaro village is a specific sensitive receptor whose management requires coordination with the Sari Khosor Nature Park administration. Bukhara deer are highly sensitive to sudden loud noise and vibration, particularly during the breeding and calving season. Although the species' managed population at the farm does not in itself constitute Critical Habitat under EBRD ESR6 criteria, its conservation importance as a captive population of an CR species makes it a high-priority receptor.

If the captive population breeding cycle remains similar to that of a wild population, then calving will commence in late April and may continue through to late June. Consultations shall be held with representatives of the breeding centre to determine the most sensitive period for late pregnancy hinds and young calves. During an agreed period there will be a restriction on high noise and high vibration activities within and agreed distance from the breeding area.

Should works be necessary then the project will erect temporary noise barriers around noise generating activities. Any sudden noises will be avoided and any equipment will be started at low power initially to reduce the risk of startle effect.

Workforce Access and Poaching Risk - The single most significant construction-phase risk to the Nature Park is the introduction of a large, mobile construction workforce into a previously remote valley with limited law enforcement presence and a tradition of subsistence hunting. The corridor will provide access to areas of the Nature Park that are currently difficult to reach. Workers from other regions may not be aware of or may not respect local protected area designations. Without effective controls, the construction workforce represents a materially elevated poaching and wildlife collection threat to the species the Nature Park exists to protect, including those that are Red Book-listed under Tajik national law.

Risk of Direct Encroachment - The project footprint does not intersect the Sari Khosor Nature Park boundary. The approximately 5 km separation between the road alignment and the nearest Park boundary means that direct encroachment from road works is unlikely. Ancillary facilities — borrow areas, spoil sites, and construction camps — shall not be sited within the Park or in any location that would represent a risk of encroachment on it. Per BMP Annex 8 §5.3, the Sari Khosor Nature Park and its associated objects (including the Bukhara deer breeding centre at Dashtaro village) are recorded



as no-go zones for ancillary facility siting in the Sensitive Feature Register, and written Ecologist sign-off is required before any proposed ancillary facility location is approved.

Operational Phase

Induced Tourism and Visitor Pressure - The Sari Khosor area is not currently easily accessible. The existing road is unpaved, frequently impassable in winter and after extreme weather events, and provides a poor travelling experience for visitors. The rehabilitation and year-round improvement of the road will materially change the access equation for both local communities and external visitors. The Nature Park, as a designated protected area in a scenic mountain valley, can reasonably be expected to see increased visitor numbers following road improvement.

Increased tourism is in many respects a positive outcome — it supports local livelihoods, raises the profile of the protected area, and generates potential revenue for the Park administration. However, unmanaged tourism growth in a protected area with limited management capacity and infrastructure can damage the very values the Park exists to protect. The risk is that visitor pressure increases faster than the Park's capacity to manage it. PIURR's engagement with the Nature Park administration during project preparation and construction, and the annual monitoring commitment, are designed to give the Park advance notice and support for this transition.

Poaching and Illegal Wildlife Access - The operational access improvement will be permanent and will benefit not only legitimate visitors but also those engaged in illegal hunting, wildlife collection, and timber or plant harvesting within the Nature Park. The Shurobdaryo corridor provides access to the Nature Park from the Baljuvon side that currently requires a difficult off-road journey. A surfaced road reduces that barrier significantly. The impact on poaching pressure is assessed as High pre-mitigation because the road improvement is permanent and the Nature Park's enforcement capacity is currently limited. This is not an impact the road project can resolve unilaterally — it requires a law enforcement and park management response that goes beyond what a road infrastructure project can commit to deliver.

The legal framework restricting hunting and wildlife take in and around the Sari Khosor Nature Park is substantial. Within the Park, hunting and wildlife collection are prohibited under the Law on Specially Protected Natural Areas (1994, as amended; 2014 version) and the Law on Protected Natural Territories (2011), except where specifically authorised by Government decree. Outside the Park, general hunting is permitted only under licence in the regulated season (typically 1 September to early March), but take of species listed on the Red Book of Fauna of Tajikistan is prohibited regardless of location, except under species-specific quota decrees. Illegal take attracts criminal liability under the Criminal Code in addition to administrative fines. International commitments under CITES and the Bonn Convention. The Project's mitigation strategy is therefore to reinforce — through worker conduct controls, awareness training, and a strict prohibition on hunting and wildlife take by the construction workforce (set out in the Code of Conduct, the Worker Induction, and ESMP measure C-BIO-06) — a legal framework that already prohibits the activities in question, and to ensure that improved access does not undermine that framework's enforcement by the Park administration and local police.

Cumulative Impacts

The cumulative impact of improved road access on the Sari Khosor Nature Park is the combined effect of construction-phase workforce pressure and operational-phase tourism and access-related pressure. These two effects are sequential rather than simultaneous and together represent a sustained increase in human pressure on the Park over a multi-year transition period. The Park administration should be engaged before construction commences so that planning for this transition can begin early. The ESMP impact register identifies cumulative impacts on the Nature Park and the surrounding communities from improved access as a Moderate risk, reflecting the genuinely positive



development outcomes of improved connectivity alongside the conservation management challenges it creates.

Transboundary Impacts

No transboundary impacts on protected areas are anticipated.



7.9.4. Impact Summary and Assessment of Significance

Table 77 provides an assessment of the significance of potential impacts on protected area interests before implementation of the proposed mitigation measures.

Table 77: Impacts and Significance – Protected Areas

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
Construction Phase												
C	Noise and vibration disturbance from construction works near the Nature Park boundary and Bukhara deer breeding farm	Bukhara deer breeding farm at Dashtaro — specifically during calving season; wildlife in Nature Park	L	H	M	M	MOD	ST	SMA	M	POSS	M
C	Increased access enabling construction workforce hunting, poaching, and wildlife collection	Wildlife within Nature Park; rare and Red Book species	L	H	L	-	MAJ	ST	INT	M	UN	M
C	Direct encroachment on Nature Park land during works or ancillary facility siting	Sari Khosor Nature Park designated area; habitats within the Park	L	H	L	-	MAJ	ST	INT	M	UN	M
Operational Phase												

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
O	Improved road access inducing increased tourist and visitor pressure on the Sari Khosor Nature Park	Sari Khosor Nature Park; protected habitats and species within the Park; Park management capacity	L	H	M	-	MAJ	LT	INT	H	POSS	H
O	Improved road access increasing poaching risk and access for illegal wildlife collection within the Nature Park and corridor	Wildlife populations within and adjacent to Nature Park; Red Book species; Bukhara deer breeding programme	L	H	M	-	MAJ	LT	INT	H	POSS	H

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minor / LT: Long term / MT: Medium Term / ST: Short term / SMA: Small / INT: Intermediate / EXT: Extensive / DEF: Definitely / POSS: Possible / UNLIKE: Unlikely. Phase: C = Construction; O = Operation.



7.9.5. Mitigation and Management Measures

The detailed biodiversity and protected area management requirements are set out in the Biodiversity Management Framework (Annex 8 of the ESMP) and the Worker Code of Conduct (Annex 12 of the ESMP). This section summarises the principal measures relevant specifically to the Nature Park.

Construction Phase

No-Encroachment on Nature Park Land — The project footprint does not enter the Sari Khosor Nature Park. All ancillary facility locations — camps, borrow areas, spoil sites, and access tracks — shall be assessed by the Contractor's Ecologist against siting criteria that exclude proximity to sensitive habitats and protected area boundaries before establishment. No ancillary facility shall be placed within any buffer or no-go zone identified in the Biodiversity Management Framework without written Engineer approval.

Bukhara Deer Farm — Calving Season Restriction — The calving season timing shall be confirmed before construction commences near the farm. During the confirmed calving period, no works generating elevated noise, vibration, or dust shall be undertaken within the agreed buffer distance of the farm boundary. The Farm Manager and Nature Park administration shall be notified at least 48 hours before any blasting, piling, or high-vibration works within the agreed buffer at any time of year. The noise and vibration controls applicable to the Bukhara deer farm are addressed in detail in the Noise and Vibration section and Annex 14 of the ESMP.

Anti-Poaching — Worker Code of Conduct and Enforcement — The mandatory prohibition on hunting, fishing, trapping, and wildlife collection by all construction workers and their dependants is set out in the Worker Code of Conduct (Annex 12 of the ESMP). This prohibition applies along the full length of the project corridor and in all areas accessible from construction camps and work fronts. Violations constitute grounds for immediate dismissal. The Code of Conduct is delivered at worker induction and reinforced through monthly biodiversity toolbox talks. The Ecologist conducts regular patrols of work fronts and camp perimeters, and any evidence of wildlife collection or hunting is recorded in the Biodiversity Register and reported to the Engineer and PIURR as a non-compliance. PIURR shall notify local law enforcement of any incident involving wildlife within the Nature Park.

Engagement with Nature Park Administration — Before construction commences, PIURR shall establish a formal communication channel with the Sari Khosor Nature Park administration. This engagement shall cover: the project's timeline and construction phases; the noise and vibration controls applicable near the deer farm; the anti-poaching provisions in the Code of Conduct; and the Nature Park's own planning for post-project access management. The Ecologist's contact details shall be shared with the Farm Manager and Nature Park Director to enable direct communication on any biodiversity concerns arising during construction.

As no Critical Habitat is present, a formal Net Gain requirement does not apply. However, the identification of Priority Biodiversity Feature habitats (C3.62 and C3.55 gravel banks) under EBRD ESR6 triggers a no-net-loss obligation for those features, regardless of Critical Habitat status. Programme requirements are set out in Section 10 of the Biodiversity Management Framework (Annex 8 of the ESMP).

Operational Phase

PIURR Engagement with Nature Park on Visitor Management — PIURR shall engage with national and local law enforcement authorities before the road opens to traffic to agree targeted enforcement measures in response to the improved access, including increased patrol frequency along the corridor and in the vicinity of the Sari Khosor Nature Park boundary during the first three years of operation. The outcomes of this engagement shall be recorded and reported to EBRD as part of the project's operational phase monitoring obligations.

Poaching Risk — Operational Phase Coordination — PIURR shall ensure that local law enforcement authorities are briefed on the increased access implications of the road improvement before the road opens to traffic. This does not require ongoing road operator commitments, but a pre-opening engagement on the part of PIURR is the minimum required to discharge the project's duty of care to the protected area.

7.9.6. Residual Impacts

Table 78 summarises residual impacts on the Sari Khosor Nature Park following implementation of the mitigation measures described above.

Table 78: Residual Impacts - Protected Areas

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Impact Significance
C	Noise and vibration — Bukhara deer farm	Medium	Residual disturbance risk is low outside the calving season. During calving, risk is managed to low through the seasonal restriction and advance notification requirement.	Low
C	Construction workforce hunting and poaching	Medium	Residual risk cannot be reduced to zero in a remote landscape, but systematic enforcement through the Code of Conduct significantly reduces it.	Low
C	Direct encroachment on Nature Park	Medium	The project footprint does not intersect the Nature Park. No material residual encroachment risk remains with pre-clearance inspections and ancillary facility siting controls in place.	Not Significant
O	Increased tourist pressure on the Nature Park	High	Residual pressure on the Nature Park is inherent to the permanent access improvement. PIURR engagement with the Park administration reduces but cannot eliminate the risk; visitor management is ultimately the Park's responsibility.	Low – Medium
O	Increased poaching risk from improved access	High	Residual poaching risk is inherent to the permanent road improvement. Pre-opening law enforcement engagement and three-year patrol coordination reduce but cannot eliminate the risk; this is fundamentally a law enforcement issue beyond the project's control.	Low – Medium

7.9.7. Monitoring

Table 79 summarises the protected area monitoring requirements for the Project. Construction-phase monitoring is the Contractor's responsibility via the Ecologist; operational-phase monitoring is the responsibility of PIURR in liaison with the Nature Park administration.

Table 79: Monitoring – Protected Areas

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Notes
Construction Phase					
Nature Park boundary monitoring	Visual inspection for any encroachment of construction activities, plant, or materials within or approaching the Nature Park boundary	Monthly during active construction in sections within 5 km of the Nature Park; after any works near the 5 km proximity zone	Along the corridor sections closest to the Sari Khosor Nature Park	Contractor (Ecologist)	Ecologist walk-over inspection log. Any proximity concern reported to Engineer and PIURR within 24 hours. GPS coordinates of Nature Park boundary to be confirmed from official sources and entered in the Sensitive Feature Register.
Bukhara deer farm — calving season compliance	Compliance with noise/vibration restriction during confirmed calving period; advance notification records; signs of animal distress at farm boundary	Daily monitoring at farm boundary when works are active within the agreed buffer; throughout the calving season	Bukhara deer breeding farm, Dashtaro village	Contractor (Ecologist / delegated trained staff)	Ecologist observation log. 48-hour advance notification records for high-noise works. Any observed animal distress reported immediately to ESHS Manager and Farm Manager. Consistent with noise/vibration monitoring in the Noise and Vibration section.
Worker Code of Conduct compliance — anti-poaching	Evidence of hunting, fishing, wildlife collection, or wildlife disturbance by construction workforce; complaints received from Nature Park or local communities; any wildlife carcasses found at or near camps	Continuous; reviewed monthly; weekly during high-risk periods (hunting seasons)	Construction camps, work fronts, and access routes throughout corridor	Contractor (ESHS Manager / Ecologist); SCLO	Monthly Code of Conduct compliance review. Any incident recorded in the Biodiversity Register and Non-Compliance Register. Disciplinary action record. Suspicious incidents reported to PIURR and local law enforcement.
Operational Phase					
Nature Park visitor numbers and management capacity	Annual visitor numbers to Sari Khosor Nature Park; Nature Park administration capacity to manage increased	Annually during the first five years of operation; reported to PIURR	Sari Khosor Nature Park	PIURR (in liaison with Nature Park administration)	Annual meeting and report from Nature Park Director to PIURR. If visitor numbers increase materially and management capacity is lagging, PIURR engages

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Notes
	visitor pressure; any known incidents of illegal activity (poaching, collection) in the Park				Ministry of Environment to discuss Park management support as part of the project's institutional strengthening commitments.
Poaching and illegal wildlife activity — road corridor	Reports of illegal hunting, poaching, or wildlife collection within the Nature Park or along the road corridor attributable to improved access	Annually; and whenever reports are received	Sari Khosor Nature Park and wider project corridor	PIURR (in liaison with Nature Park administration and local law enforcement)	Annual report from Nature Park administration and local police. Any increase in poaching incidents triggers PIURR engagement with law enforcement and Nature Park on targeted response measures.

7.10. Habitat

7.10.1. Project Activities with Potential to result in impacts on Valued Habitats

Construction

The range of potential effects on habitats and their severity is highest during the construction phase. The project will undertake typical activities for road rehabilitation in this geography; no new or novel construction techniques will be employed. Activities with potential to impact habitats include:

- direct removal of vegetation and topsoil during formation works, cut-and-fill operations, and site clearance along the existing alignment;
- working within or adjacent to the active river bed for bridge foundation installation, cofferdam construction, and — where unavoidable — extraction or disposal of river gravels;
- changes to local hydrological and drainage patterns arising from earthworks and new drainage structures;
- sedimentation and turbidity increases in the Shurobdaryo and tributary watercourses during in-river and bankside works;
- mobilisation of existing contaminated material and release of construction-related pollutants (hydrocarbons, cement, fine sediments) to soil and water; and
- poor waste management and site housekeeping.

Operations

During operation, the improved road surface will alter local drainage patterns and introduce road-derived pollutants to adjacent soils and the adjacent watercourse. The principal mechanisms are surface run-off carrying hydrocarbons, tyre rubber particulates, and general litter to the river; localised soil chemistry changes from de-icing agent spray deposited on roadside vegetation; and long-term changes in local species composition adjacent to the road edge resulting from altered light, noise, and soil conditions. The operational phase also results in a permanent improvement in access to a



remote valley, with the indirect consequence of increased human pressure on habitats and species within the broader project area of influence.

7.10.2. Sensitive Receptors

Critical Habitat

The Critical Habitat Assessment (CHA, May 2026 — presented in full as Annex D of this ESIA) assessed the project area of influence against the five EBRD ESR6 criteria for Critical Habitat designation. Following confirmation of two Critically Endangered wild pear species in the May 2026 botanical survey, the assessment concluded that the project corridor triggers Critical Habitat under Criterion 1. The determination against each criterion is summarised below:

- **Criterion 1 (Threatened Species):** triggered. The May 2026 botanical survey confirmed two Critically Endangered wild pear species along the corridor — *Pyrus tadshikistanica* (Tajikistan-endemic; 6 individuals at km 11, 15, 29, 34 and 48) and *Pyrus korshinskyi* (16 individuals at km 16, 37, 43 and 47). On a precautionary basis under ESR6 paragraph 14(ii)(c), the corridor is determined to support an important national concentration of these nationally Critically Endangered species. Critical Habitat is therefore triggered under Criterion 1, giving rise to a Net Gain obligation for both species.
- **Criterion 2 (Endemic or Range-Restricted Species):** The high level of plant endemism recorded in the Sari Khosor area reflects the biogeographic character of the South-Western Natural Province as a whole, not a concentration of endemic populations unique to the road corridor. The EAAA is not considered to hold 10% or more of the global population of any endemic or range-restricted species.
- **Criterion 3 (Migratory or Congregatory Species):** No habitat within the EAAA regularly supports 1% or more of the global population of any migratory or congregatory species at any point in the lifecycle. The confirmed autumn spawning migration of Amu Darya trout (*Salmo trutta oxianus*) is treated as a Priority Biodiversity Feature under the migratory species pathway but does not meet the population threshold for Critical Habitat designation.
- **Criterion 4 (Highly Threatened or Unique Ecosystems):** No habitats within the EAAA are listed as Priority Habitats under Annex 1 of the EU Habitats Directive, nor are any ecosystems assessed as CR or EN under the IUCN Red List of Ecosystems. Classic lowland tugai — a priority Central Asian ecosystem — is not present within the project corridor at elevations of 1,200–2,000 m.
- **Criterion 5 (Key Evolutionary Processes):** The project involves rehabilitation of an existing, long-disturbed road alignment. The direct works footprint does not extend into undisturbed mountain habitats where evolutionary processes underpinning regional plant endemism are concentrated. Criterion 5 is not triggered at the scale and footprint of this project.

The triggering of Critical Habitat under Criterion 1 gives rise to a Net Gain obligation for the two wild pear species, to be delivered through avoidance-led design and the Biodiversity Offset Programme (governed by the BOMP). This is in addition to the project's obligations with respect to Priority Biodiversity Features, which are confirmed present and trigger a no-net-loss requirement under EBRD ESR6.

Priority Biodiversity Feature Habitats

In addition to the Critical Habitat triggered for the wild pear species, two riverine habitat types within the Shurobdaryo corridor are identified as Priority Biodiversity Features (PBFs) on the basis of their listing in Annex 1 of the Bern Convention Revised Resolution 4:

- **C3.62 Unvegetated River Gravel Banks** — present throughout the Shurobdaryo channel along the full project corridor. These habitats function as spawning substrate for Amu darya trout, foraging habitat for Eurasian Otter, and nesting substrate for Ibisbill. Their dynamic, braided character



means they are naturally disturbed and capable of recovery, but direct physical loss or contamination during construction represents a real risk.

- C3.55 Sparsely Vegetated River Gravel Banks — present within the Shurobdaryo channel; the precise species composition differs somewhat from the Bern Convention habitat description, but the functional and structural similarity is sufficient to include these as PBFs on a precautionary basis.

These habitats are classified as sensitive receptors for the purposes of this impact assessment. The identification of PBF habitats triggers an obligation under ESR6 to apply the mitigation hierarchy and demonstrate no net loss of those features.

Natural and Semi-Natural Terrestrial Habitats

The majority of habitats along the existing road alignment are modified and disturbed, reflecting decades of road use, grazing, agricultural encroachment, and erosion. These areas are of limited ecological value. However, two categories of natural and semi-natural terrestrial habitat within the project area of influence warrant recognition as moderately sensitive receptors:

- Riparian scrub and bankside vegetation — fragmented poplar (*Populus* spp.), willow (*Salix* spp.), and sea buckthorn (*Hippophae rhamnoides*) growth along the Shurobdaryo banks. This vegetation does not itself qualify as a PBF but provides essential supporting habitat for confirmed PBF species including Eurasian Otter and Amu Darya Trout, and for cliff-nesting raptors and riparian bird species.
- Rocky slope and scrub habitats — sparse shrubland and herbaceous communities on undisturbed valley sides away from the existing road formation. These habitats support Red Data Book invertebrates, reptiles, and plant species and are rated as moderately sensitive.

7.10.3. Potential Impacts

Construction Phase

Direct physical loss of PBF gravel bank habitat is the primary habitat impact of concern. Bridge foundation installation, cofferdam construction, and gravel extraction from the active river bed will directly disturb or remove sections of the C3.62 and C3.55 gravel bank habitats. The spatial extent of impact at any individual crossing location is limited relative to the total gravel bank area present along the 56 km corridor, and the dynamic braided morphology of the Shurobdaryo means that gravel bank habitats have natural recovery capacity. Nevertheless, the cumulative loss across multiple bridge and crossing locations, combined with unrestricted gravel extraction, could be significant if not controlled.

Sedimentation and turbidity during in-river and bankside works will degrade water quality within and downstream of active work areas. Elevated suspended sediment loads affect the ecological function of gravel bank habitats — clogging interstitial spaces, reducing benthic invertebrate diversity, and reducing the suitability of gravels as fish spawning substrate. This indirect impact has a wider spatial footprint than direct physical disturbance and extends downstream beyond the immediate work area.

Contamination of river and soil habitats through uncontrolled releases of hydrocarbons, cement slurry, concrete washings, or fine sediments from construction plant represents a risk to both riverine and terrestrial habitats. The probability of a significant uncontrolled release is considered possible given the proximity of much of the works to the active channel.

Temporary habitat disturbance due to vegetation clearance, topsoil stripping, and construction traffic will affect terrestrial habitats within and adjacent to the works footprint. These impacts are generally reversible through reinstatement and revegetation, but the temporary loss of bankside vegetation reduces the supporting habitat available to otter, trout, and riparian bird species during the construction period.

**Operational Phase**

Changes in river water quality from road surface run-off introduce hydrocarbons, tyre rubber particulates, suspended solids, and general diffuse pollution to the Shurobdaryo. The potential for acute contamination from vehicle accidents involving fuel tankers or other hazardous loads is a low-probability but high-consequence risk for aquatic habitat.

Indirect habitat pressure from improved access represents a long-term operational risk. The permanent improvement in road quality will increase access to a valley currently partially protected by its inaccessibility. This increases the risk of poaching of large mammals and raptors, illegal collection of Red Data Book plants, and encroachment towards the Sari Khosor Nature Park boundary — all of which indirectly affect habitat quality and integrity within the EAAA.



7.10.4. Impact Summary and Assessment of Significance

Table X provides an assessment of the significance of potential impacts on habitats before implementation of the proposed mitigation measures. Impact significance is assessed based on the magnitude of the potential impact, the sensitivity of receptors, the spatial scale, timeframe, and probability of the impact occurring.

Table 80: Impacts and Significance – Habitats

Phase	Potential Impact	Receptors	No.	Sensitivity	Public Concern	Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	Direct physical loss of gravel bank habitat from bridge works, cofferdam construction, and river bed extraction	C3.62 and C3.55 PBF gravel bank habitats	2	M	L	L	MIN	ST	INT	M	DEF	M
C	Sedimentation and elevated turbidity in the river channel during in-river and bankside works, degrading gravel bank ecological function	C3.62 and C3.55 PBF habitats; natural riverine habitat	2+	M	M	M	MOD	ST–MT	EXT	H	DEF	H
C	Uncontrolled release of contaminants (hydrocarbons, cement, fines) to the river channel	Natural riverine habitat; PBF gravel banks	2+	M	M	M	MOD	MT	EXT	H	POSS	H

Phase	Potential Impact	Receptors	No.	Sensitivity	Public Concern	Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	Uncontrolled release of contaminants to terrestrial soils adjacent to the works	Natural terrestrial habitats	1+	M	L	L	MOD	MT	SMA	M	POSS	M
C	Temporary loss and disturbance of riparian bankside vegetation supporting PBF species	Riparian scrub (supporting habitat for otter, trout, raptors)	1	M	L	L	MOD	ST–MT	INT	M	DEF	M
O	Road surface run-off introducing hydrocarbons and diffuse pollutants to the Shurobdaryo	Riverine habitat including PBF gravel banks	2+	M	M	L	MOD	MT	INT	M	POSS	M
O	Acute contamination event from road accident involving hazardous load	Riverine habitat; PBF gravel banks	2+	M	M	M	MAJ	ST	EXT	H	POSS	M
O	Localised soil chemistry changes from de-icing agent spray	Roadside terrestrial habitats	1+	L	L	L	MIN	LT	SMA	L	POSS	L



Phase	Potential Impact	Receptors	No.	Sensitivity	Public Concern	Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
O	Long-term habitat pressure from increased human access (poaching, plant collection, encroachment)	Natural habitats within EAAA; Sari Khosor Nature Park	1	M	L	L	MOD	LT	EXT	M	POSS	M

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minor / LT: Long term / MT: Medium Term / ST: Short term / SMA: Small / INT: Intermediate / EXT: Extensive / DEF: Definitely / POSS: Possible / UNLIKE: Unlikely. Phase: C = Construction; O = Operation.



7.10.5. Mitigation and Management Measures

The Biodiversity Management Plan (BMP — Annex 8 of the ESMP) is the primary vehicle for translating the mitigation measures below into contractor-level operational requirements. All measures listed here are mandatory under the BMP and apply from Day 1 of site mobilisation. No vegetation clearance, ground disturbance, or earthworks shall commence without a current approved BMP in force.

PBF Gravel Bank Habitats — Construction

Extraction of materials from the active river bed shall be avoided wherever technically feasible. Alternative sources (approved land-based borrow areas) shall be used in preference. Where river bed extraction is genuinely unavoidable, works shall be confined to dry, inactive gravel bars outside the active flow channel. Vegetated bars and mid-stream islands shall not be disturbed.

Bridge foundation and cofferdam works shall be planned and executed to minimise the footprint of river bed disturbance at each crossing. Excavated gravels shall be stockpiled separately and replaced following completion of works, where feasible, to assist habitat recovery.

All in-river and bankside works — including bridge foundations, cofferdams, gravel extraction, and machinery river crossings — are prohibited between 1 November and 28 February inclusive (the Amu Darya Trout spawning exclusion window). The period April to June carries a conditional flag reflecting the national fishing ban under Tajik fisheries regulations (approximately 1 April to 15 June) and elevated hydraulic risk during the snowmelt season. In-river works during this period are not prohibited but shall be managed through the River Works Method Statement, which must demonstrate adequate control of aquatic habitat, water quality, and hydraulic safety risks before works in this period may proceed.

Silt curtains, cofferdams, and sediment controls shall be deployed at all active in-river work areas throughout the construction period, regardless of season. A turbidity monitoring protocol (in-stream turbidity measurement upstream and downstream of active works) shall be implemented and trigger thresholds established to halt works if exceedances occur.

Disposal of any material into the watercourse is prohibited, except for clean, naturally occurring gravels returned to their point of extraction. No fine sediments, concrete washings, or chemical substances shall be disposed of within the water protection zone.

Riparian Bankside Vegetation — Construction

Vegetation clearance within the 15 m riparian buffer zone (measured from the bankfull channel edge) is prohibited except where directly necessary for the works footprint. Clearance shall be conducted from the road side only; direct access to the river bank is restricted to designated crossing points.

All temporarily disturbed riparian and bankside areas shall be reinstated using locally appropriate native riparian species (poplar, willow, sea buckthorn) following completion of works in each section. Reinstatement shall be completed before the end of the first growing season following disturbance.

Terrestrial Habitats — Construction

Works shall be confined strictly to the approved footprint. No encroachment of plant, materials, or workers into adjacent undisturbed slope habitats is permitted.

Fuelling, maintenance, and chemical storage are prohibited within 50 m of the Shurobdaryo or any named tributary.

Spill kits shall be maintained on all plant operating near the watercourse. Any spill to soil or water shall be reported to the Ecologist within one hour and remediated immediately.

Operational Phase



The road drainage design shall incorporate positive drainage arrangements to intercept road surface run-off before it reaches the watercourse. Where discharge to the river is unavoidable, natural drainage features (vegetated swales, retention areas) and oil and grease interceptors shall be incorporated in the drainage system.

A road accident emergency response protocol shall include procedures for the immediate containment of spills from vehicles carrying hazardous loads, with notification to the road authority and relevant environmental regulators.

Operational phase habitat pressure from improved access shall be addressed through: engagement with national wildlife enforcement authorities to agree increased patrol frequency along the corridor; installation of wildlife awareness signage at key locations including the km 54 Sari Khosor Nature Park area; and community engagement with villages along the corridor on the protected status of Red Data Book species.

No Net Loss Obligation

The identification of C3.62 and C3.55 gravel bank habitats as Priority Biodiversity Features under EBRD ESR6 requires the project to demonstrate no net loss of these features. Residual loss of gravel bank habitat following implementation of avoidance and minimisation measures shall be quantified by the Ecologist and reported to PIURR. Where residual loss is confirmed, an offset programme — including equivalent gravel bar habitat restoration within the Shurobdaryo corridor — shall be developed and implemented in accordance with the BMP (Section 10).

7.10.6. Residual Impacts

The following table provides an assessment of residual significant impacts on habitats following implementation of the mitigation measures described above.

Table 81: Residual Impacts – Habitats

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
C	Direct physical loss of gravel bank PBF habitat from bridge works and river bed extraction	Medium	Residual physical loss of gravel bank area at bridge and crossing locations is inevitable. Natural recovery expected within 3–5 years. No-net-loss programme addresses confirmed residual loss.	Low
C	Sedimentation and turbidity during in-river works	High	Residual risk remains during bridge foundation works where full channel isolation is not achievable.	Low – Medium
C	Uncontrolled release of contaminants to the river	High	Residual risk from accident or equipment failure cannot be entirely eliminated; consequence management is the key remaining control.	Low – Medium
C	Uncontrolled release of contaminants to terrestrial soils	Medium	Residual risk is low with confined footprint and ESMP controls in place. No material residual impact anticipated.	Low

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
C	Temporary loss of riparian bankside vegetation	Medium	Residual impact confined to a temporary gap in habitat continuity during construction. Full recovery expected within 3–5 years post-works.	Low
O	Road surface run-off to Shurobdaryo	Medium	Residual diffuse run-off is a low-level chronic impact inherent to road operation, managed below significant levels through drainage design.	Low
O	Acute contamination from road accident	Medium	Residual risk from a low-probability accident event; emergency response protocol reduces consequence but cannot eliminate the risk.	Low
O	Long-term habitat pressure from improved access	Medium	Residual risk is inherent to the permanent access improvement and cannot be fully eliminated through road project measures alone.	Low – Medium

7.10.7. Monitoring

Monitoring of impacts to habitat shall be undertaken per the Project ESMP monitoring programme. Requirements are summarised in the table below.

Table 82: Monitoring – Habitat

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Notes
Construction Phase					
In-river turbidity monitoring during active in-river works	Turbidity (NTU) upstream and downstream of active work area	Continuous during active in-river works; daily readings recorded	All bridge and river crossing locations when works active	Contractor Ecologist	Establish baseline and trigger thresholds (>50 NTU above upstream baseline for >30 min = halt works). Record and report all exceedances to Engineer within 24 hours.
Gravel bank PBF disturbance footprint	Area (m ²) of C3.62/C3.55 habitat directly disturbed per crossing location	Recorded before and after works at each crossing	All bridge and river crossing locations	Contractor Ecologist	GPS-bounded area measurement and photographic record. Data reported to PIURR for no-net-loss quantification.
Gravel bar recovery monitoring	Re-establishment of unvegetated and sparsely vegetated	6-monthly post-disturbance for 2 years at each location	All disturbed crossing locations	Contractor Ecologist / PIURR	Photographic monitoring and habitat area estimation. Reported against no-net-loss targets.

	gravel bar habitat at disturbed locations				
Riparian vegetation reinstatement	Survival and establishment of reinstated native riparian species	At 3 months and 12 months post-planting	All sections of bankside clearance within riparian buffer	Contractor Ecologist	Percentage survival, species composition, and canopy cover assessment against reinstatement specification.
Construction site housekeeping and spill risk	Evidence of contaminant release; fuel/chemical storage compliance; waste management	Daily walkover during construction	All active work sites, fuel and chemical storage areas	Contractor Ecologist	Daily checklist; non-conformances recorded and closed out. Report to Engineer monthly.
Operational Phase					
Road drainage system integrity	Condition of swales, retention areas, and oil interceptors	Annually, prior to rain and snow season	All drainage structures along full corridor	Road maintenance authority	Physical inspection and recording of blockages, integrity failures, and maintenance requirements.
Road edge habitat condition	Presence of invasive or ruderal species; condition of replanted roadside trees	Biannually for first 3 years of operation	Representative sections of corridor	PIURR / road maintenance authority	Transect-based assessment. Report on invasive species presence and roadside replanting survival.

7.11. Flora and Fauna

7.11.1. Project Activities with Potential to result in significant effects on flora and fauna

Construction

All activities involving excavation of ground, grubbing of vegetation, and levelling works have the potential to adversely affect flora and fauna through direct physical impacts. The specific activities of concern are:

- direct vegetation clearance and topsoil removal, causing loss of plant communities and destruction of ground-dwelling fauna habitat;
- in-river and bankside works for bridge foundations, cofferdam construction, and gravel extraction, with potential for direct disturbance of fish spawning grounds, otter holts, and aquatic invertebrate communities;
- sedimentation and turbidity in the watercourse during in-river works, affecting aquatic species including fish and benthic invertebrates;
- noise, vibration, and dust from construction plant, causing disturbance and displacement of mobile fauna species including birds, mammals, and reptiles;
- contamination of soils, groundwater, and the river system through diffuse pollution and uncontrolled releases of hydrocarbons or chemicals;



- general human activity, poor waste management, and increased traffic creating human pressure on wildlife along the corridor; and
- introduction of invasive plant species through movement of contaminated plant, vehicles, and soil, potentially displacing native vegetation communities.

Operations

During operation, activities with potential to affect flora and fauna include:

- road surface run-off during rainfall events or snowmelt, with particular risk from first-flush contamination where pollutants accumulated during dry periods are rapidly discharged to the ecosystem;
- direct mortality or injury of fauna through vehicle collisions, particularly for species with large home ranges that cross the road corridor;
- long-term changes in species assemblages and ecosystem functioning due to chronic noise, light, and visual disturbance along the upgraded road;
- barrier effects on less mobile species — small mammals, non-flying invertebrates, reptiles — for which the open road surface constitutes an inhospitable crossing environment regardless of traffic volume; and
- increased human access to a previously remote valley, creating secondary pressures including poaching, illegal collection of Red Data Book plants, and encroachment into protected areas.

7.11.2. Sensitive Receptors

The sensitive receptors for this section are the species-level Priority Biodiversity Features (PBFs) identified through the Critical Habitat Assessment (CHA, May 2026) and the associated baseline flora and fauna assessment (Section 6.2), together with the two Critically Endangered wild pear species (*Pyrus tadshikistanica* and *P. korshinskyi*) that trigger Critical Habitat under ESR6 Criterion 1 and carry a Net Gain obligation. PBFs were identified across the Ecologically Appropriate Area of Analysis (EAAA), which is wider than the direct project footprint. The table below screens those PBFs for likelihood of significant interaction with the project, based on corridor presence rating, habitat requirements, and autecology.

Table 83: PBF Assessment

Species	Corridor Presence	Notes and Potential Effects	Mitigation (BMP Reference)	Significance (see table 82 for more details)
Wild pears — <i>Pyrus tadshikistanica</i> (CR, Tajikistan-endemic) and <i>P. korshinskyi</i> (CR) — Critical Habitat trigger	Confirmed	Confirmed in the May 2026 botanical survey: <i>P. tadshikistanica</i> (6 individuals, km 11, 15, 29, 34, 48) and <i>P. korshinskyi</i> (16 individuals, km 16, 37, 43, 47). Trigger Critical Habitat under ESR6 para 14(ii)(c). Direct loss or damage to individuals from vegetation clearance and earthworks within the footprint is the primary risk. <i>P. tadshikistanica</i> reproduces vegetatively (no observed seed reproduction in the closest reference population), making each mature individual non-substitutable and constraining translocation.	Avoidance-led design — micro-realignment review at each confirmed cluster; no-go demarcation; translocation by qualified botanist as last resort only; Net Gain delivered via Biodiversity Offset Programme (BOMP), developed with the BGCI/Kulob Botanic Garden Darwin Initiative (BAP Section 8; BMP / Annex 8).	High
Amu Darya Trout — PBF: migratory species pathway	Confirmed	Confirmed at km 54 and km 35 (Shamsiddinov, 2025). Confirmed autumn upstream spawning migration. Bridge foundation works, cofferdam installation, and gravel extraction during the Nov–Feb spawning and egg incubation period present a direct risk of redd destruction and adult mortality. Sedimentation from in-river works degrades spawning substrate and kills developing eggs. Fish passage obstruction at temporary crossings risks blocking the spawning migration.	Nov–Feb in-river exclusion window (BMP Section 6.2); River Works Method Statement (BMP Section 7.2.1); silt and turbidity controls (BMP Section 7.2.2); fish passage at all crossings (BMP Section 7.2.3); dewatering controls (BMP Section 7.2.4).	High
Eurasian Otter (<i>Lutra lutra</i>) — EN nationally	Likely	Not field-confirmed but strongly indicated by habitat quality. Bankside clearance and bridge works could directly destroy holt sites. Sedimentation reduces prey availability. Operational: road mortality risk; long-term noise and human disturbance.	Pre-construction holt survey before bankside works (BMP Row 8); 50 m holt exclusion zone Dec–Jun; bankside clearance from road side only; 100 m hydrocarbon exclusion from channel; post-construction monitoring two seasons (BMP Section 11).	High
Bukhara Deer (<i>Cervus hanglu bactrianus</i> , CR) — breeding facility at Dashtaro, km 35	Confirmed (facility)	Managed 3 ha breeding facility directly adjacent to road corridor. Confirmed PBF receptor. Construction noise, vibration, and dust could cause acute stress. Calving season (April–June) represents heightened sensitivity. Operational: increased traffic noise adjacent to facility.	48-hour Farm Manager notification before piling, blasting, or heavy earthworks within agreed buffer (BMP Sections 6.4 and 7.8); calving season restrictions; daily perimeter monitoring when works active within buffer; pre-construction site visit for baseline count.	Medium

Species	Corridor Presence	Notes and Potential Effects	Mitigation (BMP Reference)	Significance (see table 82 for more details)
European Glass Lizard (<i>Pseudopus apodus</i>) — EN nationally	Likely	Confirmed in broader Sari Khosor area. Fossorial and slow-moving — high vulnerability to mechanical clearance. Not recorded in March 2026 (early season). Direct mortality risk from clearance and topsoil stripping if not preceded by displacement survey.	Pre-construction reptile survey April–September (BMP Row 6); reptile displacement programme under Ecologist supervision; slow, sectional clearance of rocky scrub (BMP Sections 7.1 and 7.4).	Medium
Turkestan Barbel (<i>Barbus capito conocephalus</i> , VU) — precautionary PBF	Possible	Confirmed in wider area (Latifi, 2026); not recorded by Shamsiddinov (2023). Pre-construction eDNA or electrofishing survey required. If present: benthic specialist sensitive to fine sediment loading at crossing locations.	Pre-construction targeted aquatic survey (BMP Row 9); silt and turbidity controls regardless of confirmation status; Nov–Feb exclusion applies regardless of confirmation.	NS if absent; Low if confirmed
Marbled Polecat (<i>Vormela peregusna</i> , VU IUCN)	Possible	Prefers steppe and open habitats; montane valley not optimal. More fossorial — reduced road mortality risk. Unlikely to be found close to works footprint.	Pre-construction survey for crossing points from higher ground to watercourse.	Not Significant
Eastern Imperial Eagle (<i>Aquila heliaca</i> , VU IUCN)	Likely	Uses corridor as part of wide home range. Minor habitat loss. Main risk: disturbance of nesting birds during March–September causing nest abandonment.	Pre-construction nest survey before 1 March each year (BMP Section 6.3); 250 m no-works buffer around active nests; professional bird specialist monitoring.	Not Significant
<i>Tulipa praestans</i> (VU IUCN + national RDB)	Likely	May be present within works footprint on rocky slopes and scrub. Risk: direct destruction of bulbs during clearance and earthworks; soil chemistry changes reducing habitat suitability.	Pre-construction botanical survey March–May (BMP Section 6.5); if confirmed in footprint, bulbs translocated to agreed receptor site before clearance (BMP Section 7.3).	Not Significant
<i>Tulipa anisophylla</i> (VU national RDB)	Likely	As above.	Pre-construction botanical survey March–May; translocation if confirmed in footprint (BMP Section 7.3).	Not Significant

Species	Corridor Presence	Notes and Potential Effects	Mitigation (BMP Reference)	Significance (see table 82 for more details)
Yellow-eyed Pigeon (<i>Columba eversmanni</i> , VU IUCN)	Likely	Uses mountain valleys with rivers. Minor habitat loss. Main risk: disturbance of nesting birds during breeding season.	Pre-construction nest survey; 75 m no-works buffer around active nests; professional bird specialist monitoring.	Not Significant
Bearded Vulture (<i>Gypaetus barbatus</i> , EN nationally)	Likely	Wide home range; minor habitat loss. Disturbance of nesting birds and chicks during construction.	Pre-construction nest survey before 1 March; 250 m no-works buffer around active nests (BMP Section 6.3).	Not Significant
Egyptian Vulture (<i>Neophron percnopterus</i> , EN nationally/IUCN)	Confirmed	2 individuals field-confirmed March 2026. Breeding species. Wide home range. Main risk: nest disturbance during March–September.	Pre-construction nest survey before 1 March; 250 m no-works buffer around active nests (BMP Section 6.3).	Not Significant
Saker Falcon (<i>Falco cherrug coatsi</i> , EN nationally/IUCN)	Likely	Breeds on cliffs and open valleys. Main risk: nest disturbance.	Pre-construction nest survey before 1 March; 250 m no-works buffer around active nests (BMP Section 6.3).	Not Significant
Barbary Falcon (<i>Falco pelegrinoides</i> , EN nationally)	Likely	Rocky valley walls represent suitable nesting habitat. Main risk: nest disturbance.	Pre-construction nest survey before 1 March; 250 m no-works buffer around active nests (BMP Section 6.3).	Not Significant
Eurasian Lynx (<i>Lynx lynx isabellinus</i> , EN nationally)	Possible	Wide-ranging (home range 100–1,000 km ²). Project affects tiny fraction of any individual's range. Low operational road mortality risk given limited traffic.	Pre-construction survey for crossing points.	Not Significant
Snow Leopard (<i>Panthera uncia</i> , EN nationally)	Unlikely	IUCN mapping places species at or just north of corridor. Road (920–1,625 m) well below typical snow leopard elevation (>3,000 m).	Pre-construction survey for crossing points.	Not Significant
Tien Shan Brown Bear (<i>Ursus arctos</i>)	Possible	Within subspecies range; may traverse valley seasonally. Forest belt species; road works footprint unlikely to affect core habitat.	General wildlife encounter protocol (BMP Section 7.4).	Not Significant

Species	Corridor Presence	Notes and Potential Effects	Mitigation (BMP Reference)	Significance (see table 82 for more details)
<i>isabellinus</i> , EN nationally)				
Bukhara Urial (<i>Ovis vignei bochariensis</i> , CR nationally)	Possible	No field confirmation from corridor to date. IUCN range overlaps corridor. Herd species; potential crossing points at risk during construction and operational phase.	Pre-construction survey and local community consultation; if confirmed, identify crossing points and implement operational management (speed reduction, signage, reflectors).	Medium
<i>Dorcus sewertzowi</i> (EN nationally)	Possible	Forest-dependent; requires mature broadleaf trees. Unlikely within the disturbed road corridor itself.	None required.	Not Significant
<i>Polyommatus avinovi</i> (syn. <i>Afarsia avinovi</i> , EN nationally)	Unlikely	Distribution centred on Peter the Great Mountain and Dangara massif — outside project area of influence.	None required.	Not Significant
<i>Acosmeryx naga hissarica</i> (EN nationally)	Possible	Subspecies validity disputed. Habitat (riparian scrub) present but project area not representative of known records.	None required.	Not Significant
<i>Hyles apocyni</i> (EN nationally)	Possible	Not recorded from project area; riparian scrub habitat may be suitable. Limited vegetation loss anticipated.	None required.	Not Significant



In addition to the species-level PBFs assessed in Table 81, the project corridor supports a broader community of flora and fauna that, while not individually qualifying as PBFs, represents a moderately sensitive receptor. This includes common and widespread reptiles, amphibians, birds, small mammals, invertebrates, and plant communities that collectively underpin the ecological functioning of the valley. Construction disturbance, vegetation clearance, soil sealing, and operational road run-off all have the potential to affect community composition and abundance along the corridor. These general biodiversity impacts are assessed in the impact table (Table 82) under the "General flora and fauna community" receptor rows.

7.11.3. Potential Impacts

The potential impacts of the project on flora and fauna include:

- direct mortality or injury of fauna through construction plant operations during vegetation clearance, earthworks, and in-river works;
- direct destruction of Red Data Book plant populations within the clearance footprint;
- direct disturbance and destruction of otter holts, fish spawning redds, and nesting bird sites during construction activities;
- **Disturbance of gravel-bar nesting habitat** — the open unvegetated gravel bars (C3.62, a confirmed PBF habitat) provide nesting substrate for ground-nesting riverine birds. Bridge works, cofferdams, and gravel extraction during the March–July nesting season risk destroying active nests on these bars. Pre-works gravel-bar nesting checks and exclusion zones around any active nests are required (see BMP).
- indirect impacts on aquatic species through sedimentation, turbidity, and water quality changes in the Shurobdaryo;
- construction noise and disturbance displacing mobile species from habitats adjacent to the works;
- operational phase road mortality from vehicle collisions;
- long-term displacement and community composition changes from chronic noise, vibration, and human presence along the upgraded road;
- habitat severance restricting movement and gene flow for less mobile species across the road corridor; and
- secondary impacts from improved access facilitating increased hunting, poaching, plant collection, and habitat encroachment.

Two groups of receptors warrant a more detailed description of potential impacts, given their conservation status and their fixed spatial relationship to the works: the two Critically Endangered (CR) wild pear species that trigger Critical Habitat under EBRD ESR6, and the cliff-nesting vultures and raptors whose nests sit on or immediately adjacent to the alignment. Both groups are spatially fixed — sessile trees and cliff-face nests cannot move away from the works — so the magnitude of impact is governed by the proximity of each confirmed individual or nest to the engineered Right-of-Way (RoW) and the temporary works footprint.

Critically Endangered Wild Pears (Critical Habitat — Net Gain)

The May 2026 botanical corridor survey (Muhammadsoleh, 2026) field-confirmed 22 individuals of two Critically Endangered wild pear species along the alignment: *Pyrus tadshikistanica* (6 individuals, at km 11, 15, 29, 34 and 48), which is endemic to Tajikistan, and *P. korshinskyi* (16 individuals, at km 16, 37, 43 and 47). Both species are listed as CR on the IUCN Red List and in the Red Data Book of the Republic of Tajikistan (2024), and both are determined to trigger Critical Habitat under EBRD ESR6



paragraph 14(ii)(c). The consequence is that the project carries a Net Gain obligation for both species, rather than the No Net Loss obligation that applies to the Priority Biodiversity Features.

Primary impact — direct loss. The principal potential impact is the direct destruction of, or damage to, confirmed individuals during vegetation clearance, topsoil stripping and earthworks where a tree falls within the clearance footprint. Wild pears are large, long-lived woody perennials fixed in place; an affected individual cannot be displaced ahead of works, and each mature tree is effectively non-substitutable. The severity of any loss is high. *P. tadshikistanica* is a Tajik endemic for which the closest comparable national reference population — recorded by Boboev (2022) in the adjacent Dashtijum/Kulob zone — comprises only about 300 fruit-bearing trees, with no observed seed reproduction (reproduction is vegetative only). Against that reference the six corridor individuals represent on the order of 2% of the national reference population. Because mature wild pears are not generally amenable to translocation, and because *P. tadshikistanica* does not reproduce from seed in the reference population, translocation is retained only as a last resort and the loss of any individual is assessed as a HIGH residual impact.

Secondary impacts. Trees retained close to the works remain exposed to indirect effects: root-zone disturbance and soil compaction from machinery operating nearby, altered surface drainage and soil chemistry, dust deposition during the construction period, and accidental damage. Improved access along the upgraded corridor may also increase pressure from fuelwood cutting and browsing on retained individuals over the longer term.

Locations relative to the design. The confirmed locations of each species are shown against the impact footprint (RoW ± 25 m) and the Sari Khosor Natural Park boundary in the maps below. Most clusters sit on dry rocky slopes set back from the carriageway, beyond the footprint. The two individuals closest to the works are the mature *P. tadshikistanica* at km 29 and km 34, each standing in close proximity to the existing carriageway. The design team has confirmed in-design retention of both: a localised lateral alignment adjustment at each chainage keeps the tree and its immediate rooting zone outside the engineered RoW and any temporary works footprint, and this commitment is reflected in the final design drawings and tender documents. The remaining confirmed individuals are entered on the project Sensitive Feature Register with full coordinates and are subject to a corridor-wide micro-realignment review as the first-step avoidance response under the mitigation hierarchy. The km 29 and km 34 cases are illustrated in Figures X3 and X4 below.

The botanical survey concluded that the 22 recorded individuals do not necessarily represent the complete corridor population, owing to terrain, dense vegetation. A targeted pre-construction botanical survey of the engineered footprint is therefore required, and all wild pear individuals near the construction corridor are to be clearly marked before works commence, with monitoring during and after construction. Residual losses, if any, are compensated through the Biodiversity Offset Programme — developed with the BGCI/Kulob Botanic Garden Darwin Initiative (ref. 31-017) — which is the principal instrument for demonstrating Net Gain for both species.

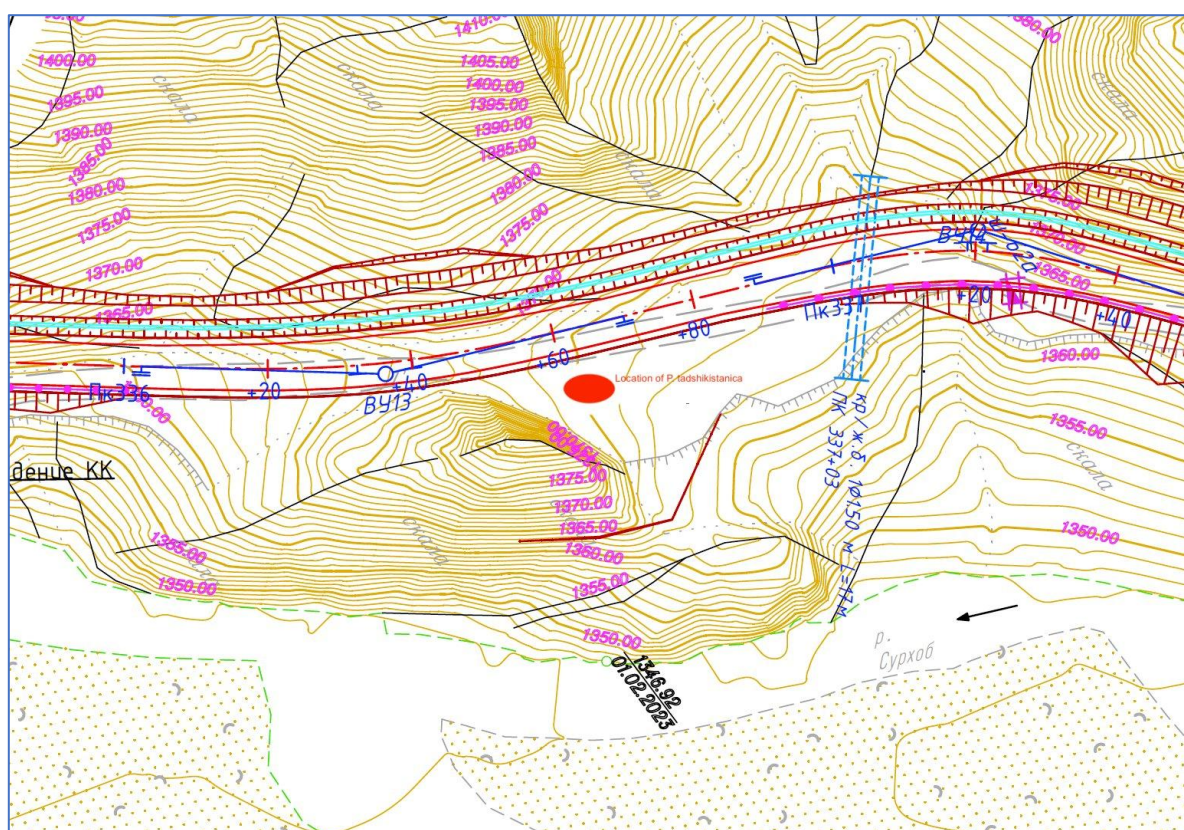
Worked example — km 29. The confirmed *P. tadshikistanica* at km 29 (38°30'45.4"N, 69°48'51.6"E, near Shahidon) stands immediately beside the alignment, within a few metres of the existing track, in an open valley-floor setting among scattered orchard and field plots. The design retains the individual outside the engineered Right-of-Way. In addition, a minor local adjustment of the alignment at this chainage — a lateral shift of a couple of metres to the east — is feasible and would increase the standoff between the carriageway and the tree, further protecting the individual and its rooting zone. As at km 34, the tree is to be demarcated as a no-go zone on the construction drawings and on the ground, with root-protection fencing, a 10 m no-disturbance buffer around the trunk, and Ecologist supervision of any activity within 20 m.

Figure 56: Confirmed *Pyrus tadshikistanica* at km 29 (38°30'45.4"N, 69°48'51.6"E, near Shahidon), immediately beside the existing alignment (yellow).



Worked example — km 34. The relationship between a retained tree and the works is illustrated by the confirmed *P. tadshikistanica* at km 34 (design stationing approximately PK 336+80 – PK 337). The individual stands immediately south of the existing track, on the downslope side toward the Shurobdaryo river. At this chainage the rehabilitated road is widened by cutting into the higher ground on the north side of the existing alignment; the design earthworks — the cut slopes and the reinforced-concrete culvert (Ø1.5 m, L = 17 m) at PK 337+03 — are offset northward, away from the tree. As a result the individual falls just outside the planned construction zone and the earthwork limits, consistent with the in-design retention commitment for this chainage. It nonetheless lies very close to the works boundary and remains exposed to incidental damage, soil disturbance and machinery encroachment. It must therefore be physically protected throughout construction: demarcation as a no-go zone on the construction drawings and on the ground, root-protection fencing at the edge of the works, a 10 m no-disturbance buffer around the trunk, and Ecologist supervision of any activity within 20 m.

Figure 57: Confirmed *Pyrus tadshikistanica* at km 34 (design station approx. Пк 336–337). Upper: position relative to the existing alignment (yellow), on the downslope/river side. Lower: position (red marker) on the detailed design — the road earthworks cut into the slope on the north side of the alignment, leaving the tree just outside the construction zone but in close proximity, requiring protection during works. (Figure number to be assigned on insertion.)



Cliff-Nesting Vultures and Raptors

The May 2026 bird and raptor surveys (Khursand & Nugzar / Talbonov, 2026, Stage 1; Garibmamadov, Talbonov et al., 2026, Stage 2; Ergashev, 2026) confirmed corridor breeding by cliff-nesting scavenging raptors. Six active Egyptian Vulture (*Neophron percnopterus*, EN) nests were tabulated and re-confirmed as occupied at Stage 2, distributed as: one nest at the km 2–4 cliff-face cluster (within the



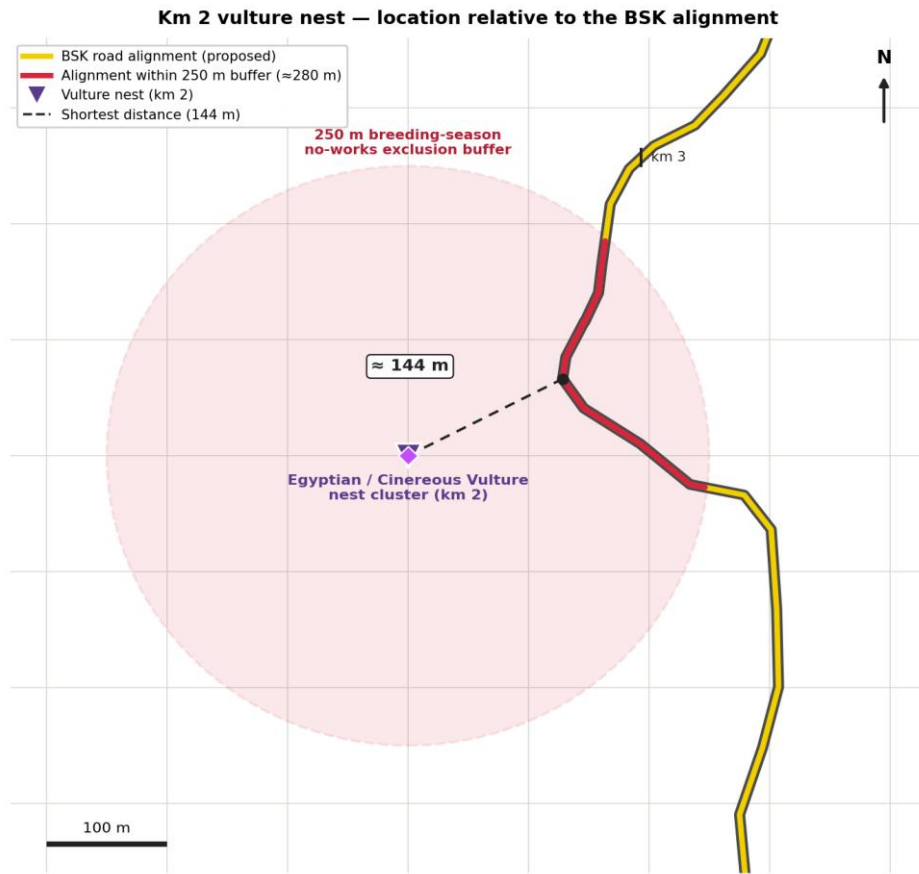
works zone), three nests at approximately km 30, and two nests at approximately km 34. A further two nests referenced near km 36 in the survey narrative are not tabulated and are treated as provisional pending Stage 3 confirmation. One active Cinereous Vulture (*Aegypius monachus*; IUCN Near Threatened, national VU) nest occurs at the same km 2–4 cliff-face cluster; with a national breeding population estimated at only 40–50 pairs, this species is a Priority Biodiversity Feature under EBRD ESR6 paragraph 12(iii). A single Barbary Falcon (*Falco pelegrinoides*, EN nationally) territory was confirmed at the km 34 cliff face. Bearded Vulture and Saker Falcon are carried precautionarily as PBFs pending Stage 3 occupancy surveys.

Primary impact — breeding disturbance. The principal potential impact is disturbance of active nests during the breeding season (1 March – 30 September), which can cause nest abandonment and the loss of eggs or chicks. The disturbance pathways are construction noise and vibration (particularly blasting, piling and heavy earthworks), dust, machinery movement, and increased human presence on the cliff-face sections. The impact is most acute at the km 2–4 cluster, where an Egyptian Vulture nest and a Cinereous Vulture nest share a single cliff face that lies directly within the works zone — the only confirmed nests inside the engineered footprint. The remaining nests at km 30 and km 34 sit on cliffs set back from the carriageway and are exposed mainly to disturbance from the nearest works rather than to direct loss.

Locations relative to the design. The km 2–4 cluster is the critical receptor and is treated as a single sensitive feature in the BMP, with a 250 m no-works exclusion buffer applied throughout 1 March – 30 September. A design-team review of micro-realignment options at km 2–4 is required to maximise the standoff distance, and programme management is to schedule heavy earthworks at km 2–4 outside the breeding season where practicable. A pre-construction nest survey is undertaken before 1 March each year; the 250 m buffer applies to each confirmed active nest, and nests not active in a given season are released from the buffer following Ecologist sign-off. (Two Cinereous Vultures recorded in flight near km 14 are interpreted as foraging movement, not a separate nesting territory.)

Protection of the km 2 vulture nest. Of the confirmed cliff-nesting raptor nests along the corridor, the nest clusters at approximately km 30 and km 34 sit on cliffs set well back from the alignment and are sufficiently distant that direct construction effects are not anticipated; their protection is provided by the standard pre-construction nest survey and the 250 m breeding-season exclusion buffer applied to any confirmed active nest. The single exception is the **km 2 nest**, a shared cliff-face cluster holding one Egyptian Vulture nest and one Cinereous Vulture nest (PBF) close to the alignment. As shown in the figure below, the nest lies approximately 145 m from the proposed alignment at its closest approach (around km 2.8). Because the nest is closer than the 250 m exclusion radius, the alignment passes through the breeding-season buffer: a reach of roughly 280 m of road, between about km 2.6 and km 2.9, falls within 250 m of the nest. This nest therefore requires specific, additional protection over and above the standard corridor measures.

Figure 58: Km 2 Egyptian / Cinereous Vulture nest relative to the BSK alignment. The nest lies ≈ 145 m from the alignment at the closest approach; the alignment passes within the 250 m breeding-season no-works exclusion buffer (red reach, ≈ 280 m). Alignment from BSK_New (June 2026); nest location from the PT4/EV survey waypoint. Schematic plan, local metric grid (100 m).



7.11.4. Impact Summary and Assessment of Significance

Table 84 provides an assessment of the significance of potential impacts on Habitats before implementation of the proposed mitigation measures. Impact significance is assessed based on the magnitude of the potential impact, the sensitivity of receptors, the spatial scale, timeframe, and probability of the impact occurring.

Table 84: Impacts and Significance – Flora and Fauna

Phase	Potential Impact	Receptors	No.	Sensitivity	Public Concern	Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	Direct mortality of adult trout and destruction of redds during in-river works within the Nov–Feb spawning and incubation window	<i>Salmo trutta oxianus</i> — Amu Darya Trout PBF	L	H	M	H	MAJ	ST	INT	H	POSS	H
C	Sedimentation and turbidity from in-river and bankside works degrading spawning substrate and reducing prey availability	Amu Darya trout; fish community; Eurasian Otter	M	H	M	M	MOD	ST–MT	EXT	H	DEF	H
C	Direct destruction of otter holts during bankside clearance and bridge works	Eurasian Otter (<i>Lutra lutra</i>) — PBF	L	H	M	H	MAJ	LT	INT	H	POSS	H
C	Indirect impacts on otter through water quality changes	Eurasian Otter — PBF	L	H	M	M	MAJ	MT	INT	M	POSS	M

Phase	Potential Impact	Receptors	No.	Sensitivity	Public Concern	Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	affecting prey availability											
C	Displacement of otter due to construction noise, vibration, and human activity	Eurasian Otter — PBF	L	H	M	L	MIN	ST	INT	L	POSS	L
C	Noise, vibration, and dust impacts on Bukhara Deer breeding facility — stress response and calving disruption	Bukhara Deer (<i>Cervus hanglu bactrianus</i> , CR) — PBF receptor	L	H	M	H	MOD	ST–MT	SMA	M	DEF	M
C	Direct mortality of European Glass Lizard during vegetation clearance and earthworks	<i>Pseudopus apodus</i> — PBF	L	M	L	M	MOD	ST	SMA	M	POSS	M
C	Direct loss of Red Book plant species within clearance footprint	Red Book plant species — PBFs and others	L	M	L	M	MOD	LT	SMA	M	POSS	M
C	Disturbance of cliff-nesting raptors during breeding season	Egyptian Vulture, Bearded Vulture, Saker	M	M	M	M	MOD	MT	INT	M	POSS	M

Phase	Potential Impact	Receptors	No.	Sensitivity	Public Concern	Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	causing nest abandonment	Falcon, Barbary Falcon, Eastern Imperial Eagle — PBFs										
C	Displacement of Bukhara Urial due to construction disturbance	<i>Ovis vignei bochariensis</i> — Bukhara Urial, CR nationally	L	H	M	M	MAJ	MT	INT	M	POSS	M
C	Direct loss of communities and ecosystem functioning due to habitat loss and disturbance	General flora and fauna community	H	L	L	L	MOD	MT	INT	M	DEF	M
C	Direct destruction of Ibisbill nesting sites on gravel bars during in-river and bankside works within the March–July nesting season	Ibisbill (<i>Ibidorhyncha struthersii</i>) – Nationally EN	L	H	M	L	MAJ	ST	SMA	M	POSS	M
C	Introduction of invasive species through plant and soil movement,	Native plant communities	H	L	L	L	MIN	LT	INT	L	POSS	L

Phase	Potential Impact	Receptors	No.	Sensitivity	Public Concern	Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	displacing native flora											
O	Aquatic species impacts through road run-off and diffuse pollution	Amu darya trout; fish community; Eurasian Otter	M	H	M	M	MOD	LT	INT	M	POSS	M
O	Direct road mortality — vehicle collisions	Eurasian Otter; Bukhara Urial	L	H	M	M	MIN	LT	SMA	M	POSS	M
O	Long-term displacement from chronic noise, vibration, and human presence	Eurasian Otter; general fauna	L	H	M	L	MIN	LT	INT	M	POSS	M
O	Operational noise and traffic disturbance to Bukhara Deer facility	Bukhara Deer breeding facility — PBF receptor	L	H	L	L	MOD	LT	SMA	M	DEF	M
O	Displacement of Bukhara Urial due to operational traffic and noise	Bukhara Urial (CR nationally)	L	H	M	M	MOD	LT	SMA	M	POSS	M
O	Secondary habitat and species pressure from improved access	All PBF species and habitats within EAAA	H	H	L	H	MOD	LT	EXT	H	POSS	H



Phase	Potential Impact	Receptors	No.	Sensitivity	Public Concern	Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	(poaching, plant collection, encroachment)											

Key: **H**: High / **M**: Medium / **L**: Low / **MAJ**: Major / **MOD**: Moderate / **MIN**: Minor / **LT**: Long term / **MT**: Medium Term / **ST**: Short term / **SMA**: Small / **INT**: Intermediate / **EXT**: Extensive / **DEF**: Definitely / **POSS**: Possible.
 Phase: **C** = Construction; **O** = Operation. No. column: **L** = single receptor/species; **M** = 2–3 receptors; **H** = multiple species or community level.

7.11.5. Mitigation and Management Measures

The Biodiversity Management Plan (BMP — Annex 8 of the ESMP) is the primary operational document translating the measures below into contractor requirements. All measures apply from Day 1 of site mobilisation. No vegetation clearance, ground disturbance, or earthworks shall commence without a current approved BMP in force and a Pre-Clearance Certificate issued for the relevant section (BMP Section 5.1).

Wild Pears — Critical Habitat (Net Gain)

- The mitigation hierarchy applies to *Pyrus tadshikistanica* and *P. korshinskyi* with Net Gain as the required outcome under ESR6. Avoidance is tested first: the design team shall review micro-realignment options at each confirmed tree cluster (km 11, 15, 16, 29, 34, 37, 43, 47, 48) before clearance, and confirmed trees shall be demarcated as no-go zones on construction drawings and on the ground (BMP; Sensitive Feature Register).
- Trees at KM29 and 34 shall be physically protected throughout construction: demarcation as a no-go zone on the construction drawings and on the ground, root-protection fencing at the edge of the works, a 10 m no-disturbance buffer around the trunk, and Ecologist supervision of any activity within 20 m.
- No clearance of, or works within the root protection zone of, any confirmed wild pear shall proceed without prior written PIURR approval.
- Translocation of mature trees shall be undertaken only as a last resort, by a qualified botanist, with realistic caveats on success (particularly for *P. tadshikistanica*, which reproduces vegetatively); the translocation plan and receptor site shall be approved by the Engineer and CEP before clearance.
- Residual losses shall be compensated through the Biodiversity Offset Programme, governed by the Biodiversity Offset Management Plan (BOMP) and developed in cooperation with the BGCI/Kulob Botanic Garden Darwin Initiative, to deliver measurable Net Gain for both species.

Amu Darya Trout and Aquatic Species

- All in-river and near-channel works are prohibited between 1 November and 28 February inclusive (the trout spawning and egg incubation exclusion window — BMP Section 6.2). This covers bridge piling, cofferdam installation, bank protection, gravel extraction, and temporary in-channel structures. Deviation requires 14 days' written notice and written approval from both the Engineer and PIURR.
- A River Works Method Statement (RWMS) shall be prepared and approved by the Engineer before any works commence within or adjacent to the bankfull channel (BMP Section 7.2.1). The RWMS must address sequencing, silt controls, concrete handling, fuelling, fish passage, and dewatering.
- Silt fences and sediment traps shall be installed downstream of all active in-channel works before machinery enters. Turbidity at 500 m downstream shall be monitored visually daily; a visible plume extending beyond 500 m triggers work stoppage (BMP Section 7.2.2).
- All temporary crossings shall be designed and confirmed by the Ecologist to maintain continuous fish passage throughout the construction period. Minimum 150 mm flow depth at temporary fords during low-flow conditions (BMP Section 7.2.3).
- Water pumped from cofferdams or dewatered sections shall be discharged to a lined settling pond before release. Fish encountered during pump-down shall be rescued by net and released downstream (BMP Section 7.2.4).



- A pre-construction targeted aquatic survey (eDNA or electrofishing) for Turkestan Barbel shall be completed before any in-river works commence, in accordance with BMP Row 9.
- Fuel and chemical storage is prohibited within 200 m of the Shurobdaryo or any named tributary. Refuelling is prohibited within 50 m of the bankfull channel edge. Spill kits shall be carried on all machinery operating within 100 m of the river and positioned at all active work sites near the watercourse (BMP Section 7.2.1).

Eurasian Otter

- A pre-construction holt and activity survey shall be completed along the full corridor before any bankside clearance or in-river works commence. Survey results are entered in the Sensitive Feature Register and approved by the Engineer (BMP Row 8).
- A 50 m exclusion zone around each confirmed holt shall be physically demarcated, with no works permitted within that zone during the breeding season (December–June) (BMP Row 8, Section 5.2).
- Bankside vegetation clearance shall be conducted from the road side only, with no direct access to the river bank except at designated crossing points (BMP Section 7.1).
- Post-construction monitoring of otter activity along the corridor shall be conducted for a minimum of two seasons following completion of works (BMP Section 11).

Bukhara Deer Breeding Facility (km 35)

- A pre-construction site visit shall establish the baseline population count and assess the facility's sensitivity to noise and vibration before works reach km 50 (BMP Section 6.4).
- The Farm Manager shall be notified at least 48 hours before any piling, blasting, or heavy earthmoving within the agreed buffer distance (BMP Sections 6.4 and 7.8).
- During the confirmed calving period (likely April–June — to be confirmed with Farm Manager at mobilisation), no works generating elevated noise or vibration shall be conducted within the agreed buffer without specific Engineer approval (BMP Section 6.4).
- The Ecologist shall monitor the farm perimeter at the start and end of each working day for signs of animal distress when works are active within the buffer (BMP Section 7.8).

European Glass Lizard

- A pre-construction reptile survey shall be conducted during the active season (April–September) before any vegetation clearance or earthworks commence in rocky slope and scrub habitats (BMP Row 6).
- If confirmed within the works footprint, a reptile displacement programme shall be implemented under Ecologist supervision before clearance begins. Clearance of rocky scrub shall proceed slowly and in sections to allow displacement of individuals (BMP Sections 7.1 and 7.4).

Ibisbill

- Before any in-river or bankside works commence in each section, the Ecologist shall conduct a targeted survey of all gravel bars within the works footprint for evidence of Ibisbill nesting activity. Surveys shall be timed to coincide with the onset of the nesting season and shall be repeated before works recommence following any break of more than two weeks during the March–July period.
- Where active nests are confirmed, a minimum 100 m exclusion zone shall be established around each nest and no in-river or bankside works shall be undertaken within that zone until the nest is confirmed as inactive by the Ecologist.



- Works on gravel bars shall not commence during the March–July nesting window without a written clearance from the Ecologist confirming no active nests are present within the works footprint.
- These requirements will be incorporated into the BMP as a dedicated Ibisbill protocol before the BMP is finalised for contract issue

Red Book Plant Species

- A targeted pre-construction botanical survey for spring-flowering Red Book species (Tulipa, Eremurus, Juno/Iris, Allium) shall be completed during March–May 2026 (BMP Section 6.5).
- Vegetation clearance in sections where Red Book plant species are recorded or flagged shall proceed during March–May only after the Ecologist has confirmed absence or completed translocation of individuals to an agreed receptor site before clearance begins (BMP Sections 6.5 and 7.3).
- Outside March–May, in sections with confirmed Red Book plant records, topsoil shall be stripped carefully and bulb or corm material encountered shall be collected and relocated by the Ecologist rather than discarded with general spoil (BMP Section 7.3).
- All translocation events shall be recorded in the Biodiversity Register and translocated individuals monitored through one complete biological cycle (BMP Section 7.3).

Cliff-Nesting Raptors

- The Ecologist shall conduct a pre-season nest survey of all potential nesting locations by the end of February each year (BMP Section 6.3).
- Vegetation clearance, felling, scrub removal, and cliff face excavation or blasting at confirmed nesting locations is prohibited between 1 March and 30 September inclusive (BMP Section 6.3).
- No-works exclusion zones apply around active nests: 250 m for Egyptian Vulture, Bearded Vulture, Saker Falcon, Barbary Falcon, and Eastern Imperial Eagle; 75 m for Yellow-eyed Pigeon (BMP Row 5, Section 5.2).
- **Construction traffic.** The existing road through km 2 is the only access route into the corridor and will carry construction and supply traffic throughout the construction period; this traffic passes within the 250 m buffer and is a year-round disturbance source independent of the active earthworks. Standard traffic-management mitigation is therefore applied on the buffer reach (about km 2.6 – km 2.9): a reduced speed limit, a prohibition on the use of engine (exhaust) brakes and horns, no night-time haulage through the reach during the breeding season, no idling or stopping within the reach, and maintenance of the running surface to limit noise and dust. These controls are set out in the Traffic Management Plan and cross-referenced in the BMP.
- **Breeding-season earthworks stop-work.** A clear stop-work period applies to all earthworks within the 250 m buffer reach during the breeding season (1 March – 30 September inclusive): no blasting, piling, rock excavation, cut/fill, or other heavy earthworks are permitted within this reach during the breeding season. Earthworks at km 2 are to be programmed for the non-breeding window (1 October – 28 February). The stop-work period is confirmed each year by the pre-construction nest survey before 1 March; if the nest is confirmed inactive in a given season, the reach may be released for works following Ecologist sign-off, while the construction-traffic controls remain in force. A design-team review of micro-realignment options at km 2 is also required to maximise the standoff distance where feasible. With these measures — traffic controls year-round and the breeding-season earthworks stop-work — the residual impact on the km 2 nest is assessed as LOW.

Bukhara Urial

- Pre-construction survey and community consultation shall continue to establish presence or absence in the project corridor.
- If confirmed present, regular crossing points shall be identified and operational management measures implemented: speed reduction, wildlife warning signage, and night-time reflective devices at crossing points.

General Measures

- All works are confined strictly to the approved footprint; no encroachment of plant, workers, or materials into adjacent undisturbed habitats (BMP Section 5.2).
- Zero-tolerance prohibition on hunting, fishing, trapping, and plant collection applies to all Project workers at all times within the project area of influence (BMP Section 7.5).
- All workers receive a biodiversity induction before commencing ground-disturbing activities and monthly biodiversity toolbox talks throughout construction (BMP Section 7.5.1).
- Invasive species prevention: all plant arriving from outside the corridor is cleaned before entering the site; disturbed areas are revegetated with native seed mixes as quickly as possible after disturbance (BMP Section 7.6).
- Dust, noise, and light controls are applied in the vicinity of the riparian buffer and all confirmed PBF locations (BMP Section 7.7).

7.11.6. Residual Impacts

The following table provides an assessment of residual significant effects on flora and fauna following implementation of the mitigation measures described above.

Table 85: Residual Impacts – Flora and fauna

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
C	Amu Darya trout redd destruction and adult mortality during in-river works	High	Residual risk is confined to unforeseen programme overrun into the Nov–Feb restricted period, which requires specific written approval to proceed.	Low
C	Sedimentation and turbidity affecting aquatic species	High	Residual risk from isolated equipment failure or flood event during construction cannot be fully eliminated.	Low – Medium
C	Direct destruction of otter holts during bankside works	High	Residual risk from undetected holts at unsurveyed locations, managed through pre-clearance inspections.	Low
C	Indirect impacts on otter through prey availability changes	Medium	Residual risk from uncontrolled release during construction cannot be entirely eliminated.	Low
C	Construction disturbance to Bukhara deer breeding facility	Medium	Residual risk from cumulative noise during extended works in the km 50–56 section.	Low

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
C	Mortality of European Glass Lizard during clearance	Medium	Residual risk from individuals not encountered during pre-construction survey.	Low
C	Direct destruction of Ibisbill nesting sites	Medium	Residual risk is low where survey and exclusion protocols are followed; cannot be fully eliminated without confirmed survey results.	Low
C	Destruction of Red Book plant populations within footprint	Medium	Residual risk where translocation is unsuccessful; monitoring over one complete biological cycle required.	Low
C	Disturbance of cliff-nesting raptors	Medium	Residual risk from nests not identified in pre-season survey.	Low
C	Displacement of Bukhara Urial	Medium	Residual risk if presence confirmed and crossing routes overlap with active works areas.	Low
C	General habitat loss and fauna displacement	Medium	Full habitat function recovery expected within 3–5 years post-construction.	Low
O	Aquatic species impacts from road run-off	Medium	Residual diffuse contamination managed below significant threshold through drainage design.	Low
O	Road mortality — otter and Bukhara Urial	Medium	Residual risk cannot be fully eliminated at confirmed crossing points.	Low
O	Long-term displacement from chronic disturbance	Medium	Not fully reducible given the nature of the project; otter activity monitored post-construction for two seasons.	Low – Medium
O	Ongoing disturbance to Bukhara deer facility from operational traffic	Medium	Residual risk from permanent traffic increase; enclosed facility reduces but does not eliminate exposure.	Low
O	Secondary pressure from improved access (poaching, plant collection, encroachment)	High	Long-term risk remains given the permanent nature of the access improvement; partially reducible through enforcement and community awareness.	Low – Medium

7.11.7. Monitoring

Monitoring of impacts on flora and fauna shall be undertaken per the Project ESMP monitoring programme. Requirements are summarised in the table below.

Table 86: Monitoring – Flora and Fauna

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Notes
Construction Phase					
Pre-construction holt survey — Eurasian Otter	Presence of holts, spraints, slides, and other otter signs	Before any bankside clearance or in-river works; repeat before works reach each new section	Full corridor — both banks of Shurobdaryo	Contractor Ecologist	Bank-side walk-over survey. Results entered in Sensitive Feature Register. Approved by Engineer before bankside clearance commences.
Pre-construction nest survey — cliff-nesting raptors	Active nesting locations of Egyptian Vulture, Bearded Vulture, Saker and Barbary Falcons, Eastern Imperial Eagle, Yellow-eyed Pigeon	Annually, completed by end of February before 1 March restriction begins	All cliff faces, tall scrub, and rocky outcrops within corridor	Contractor Ecologist	Binocular observation survey. New locations entered in Sensitive Feature Register and exclusion zones demarcated before 1 March (BMP Section 6.3).
Pre-construction botanical survey — Red Book plants	Presence and location of Tulipa, Eremurus, Juno/Iris, Allium and other Red Book plant species within works footprint	March–May 2026; annually before works reach new sections in spring	All sections with shrubland, grassland, or rocky slope habitats	Contractor Ecologist / ESIA botanist	Targeted transect survey. Species confirmed in footprint trigger translocation protocol (BMP Section 6.5 and 7.3). Results in Sensitive Feature Register.
Pre-construction reptile survey — European Glass Lizard	Presence of Pseudopus apodus and other Red Book reptiles within works footprint	April–September 2026, before clearance in rocky slope and scrub habitats	Rocky slope and scrub sections along corridor	Contractor Ecologist	Active season transect survey including visual search under rocks and debris. If confirmed, displacement programme implemented before clearance begins (BMP Row 6).
Pre-construction aquatic survey — Turkestan Barbel	Presence/absence of Barbus capito conocephalus in project river corridor	Before any in-river works commence	Four sampling points: km 1, km 20, km 35, km 54	Contractor Ecologist / aquatic specialist	eDNA sampling or electrofishing survey. Results determine applicability of species-specific controls (BMP Row 9).
Bukhara Deer facility baseline and	Animal numbers, condition, and behavioural	Pre-construction visit; daily	Dashtaro village facility, km 35	Contractor Ecologist	Pre-construction baseline count and sensitivity assessment

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Notes
construction monitoring	indicators of disturbance; Farm Manager liaison	perimeter monitoring when works active within agreed buffer			(BMP Section 6.4). Daily check records maintained in Biodiversity Register. 48-hour notification to Farm Manager before noisy works (BMP Section 7.8).
Ibisbill nesting survey and exclusion compliance	Evidence of active nests within works footprint; exclusion zone establishment and integrity	Pre-construction survey before works in each section; repeated after any break >2 weeks during March–July	All gravel bars within works footprint	Contractor Ecologist,	Survey records and photographic evidence on file. Exclusion zone maps submitted to Engineer. Zero works within confirmed exclusion zones.
Red Book plant translocation monitoring	Survival and establishment of translocated individuals	At 3, 12, and 24 months post-translocation	All receptor sites used for Red Book plant translocation	Contractor Ecologist	Percentage survival, vegetative vigour, and reproductive status. Reported in quarterly ESHS report (BMP Section 7.3).
Biodiversity induction and toolbox talk delivery	Attendance records for pre-work inductions and monthly talks	Before ground-disturbing works commence (induction); monthly throughout construction	All work sites	Contractor Ecologist	Signed attendance records maintained. Submitted to Engineer monthly (BMP Section 7.5.1).
Operational Phase					
Post-construction otter monitoring	Evidence of otter return and re-establishment along corridor (spraints, holts, slides)	Two seasonal surveys (spring and autumn) for minimum two years post-construction	Full corridor — both banks	PIURR / road maintenance authority	Survey methodology consistent with pre-construction baseline to enable comparison. Report findings to PIURR (BMP Section 11).
Road mortality monitoring	Presence of dead or injured fauna on or adjacent to road surface	Monthly drive-through survey for first two years of operation	Full corridor	Road maintenance authority	Record by species (where identifiable), location, and chainage. Flag clustering of mortality events to PIURR for review.
Bukhara Deer facility operational monitoring	Animal numbers, condition, and behavioural indicators of chronic	Biannually during first three	Dashtaro village facility, km 35	PIURR / Sari Khosor Nature Park management	Liaison with Farm Manager; population count and condition assessment. Report any evidence of

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Notes
	road disturbance traffic	operational years			distress or population decline.

7.12. Land Use & Livelihoods

This section assesses impacts on land use and land-based livelihoods associated with the BSK Project. Data are drawn from the Resettlement Plan (RP) socio-economic survey (2026), which is preliminary and subject to finalisation. The RP identifies 116 directly affected parcels with a combined total affected area of approximately 54.6 ha. All impacts are partial — no parcel is fully acquired. The project corridor passes through a landscape of mixed agricultural, pasture, residential, and forestry land use, with livelihoods predominantly land-based.

7.12.1. Project Activities with Potential to result in land use and livelihoods impacts

- Road widening of 1–2 m on each side along the 56 km corridor — the primary source of permanent partial land take on all affected parcels.
- Borrow pit development at identified reserve locations — temporary land use affecting agricultural and pasture land adjacent to the road.
- Spoil disposal at identified sites — temporary use of land for excavated material.
- Construction camp and ancillary facility establishment — temporary land use at camp locations.
- Bridge and culvert construction — localised land take and access restriction at crossing points.
- Construction of river bank protection, drainage, and retaining structures — disturbance to land immediately adjacent to the formation.

7.12.2. Sensitive Receptors

Household agricultural landholders (55 HH DAPs) — Smallholder farming households cultivating vegetables and wheat on affected parcels. All 42 households who responded confirm they can continue agricultural activities on the same land following partial take, indicating strip-only impacts. However, loss of productive plot margins, boundary trees, and irrigation access can affect seasonal yields.

Fruit tree owners (46 DAPs) — Landholders with affected orchards and productive trees (apple, apricot, mulberry, walnut, quince, almond, cherry, grape, pear, plum, pomegranate). Productive fruit trees represent multi-year investment and are a significant household income and food security asset. ~3,080 trees are affected, of which approximately 2,943 are productive.

Dehkan and legal entity land users (17 LE DAPs) — Registered dehkan farms holding agricultural and orchard land under permanent or long-term use rights. Includes one large dehkan farm parcel of 11.86 ha (partial take only). Formal legal entities are better positioned to navigate compensation processes but are sensitive to impacts on registered productive assets.

Registered commercial business (1 DAP — ZAO "Asali Sari Khosor", km 31+800–31+840) — A registered closed joint-stock company (ZAO) operating a honey production facility on the left side of the road at km 31+800–31+840, within the Shahidon Jamoat. The affected structure comprises a concrete foundation and metal perimeter fencing (18.8 m² total; 6.4 m² foundation and 12.4 m² fencing), built in 2017 and legally registered. The project affects 15 m² of the plot. The RP survey records honey production as a secondary rather than primary livelihood activity for the owner. As a registered legal entity, the business requires treatment as a distinct affected party under ESR5,



including confirmation that the partial land and structure take does not impair business operations and that compensation reflects the full replacement value of affected structures.

Pastoral land users (18 pasture parcels) — Households and community groups using seasonal grazing land along the corridor. Pasture accounts for 36.4 ha — 66% of total affected area. Pastoral use is extensive and communal; 38 DAPs report no alternative land available.

Households without alternative land (38 DAPs) — Thirty-eight directly affected parties report no available alternative agricultural or residential land. These are the most land-constrained households and face the most limited capacity to substitute for lost land use.

7.12.3. Potential Impacts

Table 87 summarises the land use categories and affected areas identified in the RP survey.

Table 87: Affected Land Parcels by Land Type (Preliminary RP Data, 2026)

Land Type	Parcels	Affected Area (m ²)	Affected Area (ha)	Notes
Residential / household plot	52	10,633	1.06	Mean 204 m ² per parcel; boundary strips only
Agricultural land	38	26,823	2.68	Vegetables and wheat; 9 parcels irrigated
Pasture	18	364,395	36.44	Communal seasonal grazing; largest category by area
Dehkan farm	1	118,600	11.86	Single large farm parcel; partial take only
Orchard / garden	5	22,430	2.24	Fruit trees; productive assets
Commercial	1	15	<0.01	Negligible
Total	116	543,896	54.60	All impacts partial; no parcel fully acquired

Source: RP Socio-economic Survey, 2026 (preliminary). All figures represent affected portions; no parcel is fully acquired.

Construction Phase

Permanent Partial Land Take — Road widening removes strips of land from 116 parcels across all land types. The mean affected area per residential parcel is only 204 m², confirming boundary-strip impacts. For agricultural parcels, the mean affected area is 706 m² (0.07 ha). Twenty-two parcels lose more than 20% of their total plot area; these are considered severely affected and require specific livelihood restoration measures. Thirty-six per cent of DAPs lack title documentation, which must be addressed in the RP compensation verification process.

Loss of Fruit Trees and Perennial Crops — Approximately 3,080 trees and perennial plants are affected across the corridor, of which approximately 2,943 are productive fruit trees. Species include apple, apricot, mulberry, walnut, almond, cherry, grape, pear, plum, pomegranate, and quince. Productive trees represent years of investment; loss of established trees has a multi-year livelihood impact extending beyond the construction period until replacement trees reach productive age. This is the most significant individual livelihood impact of the project.

Loss of Annual Crops — Twenty-four DAPs report annual crop losses, primarily vegetables (38 plots) and wheat. Most households can continue cultivation on unaffected portions of the same plot following partial take. Impact is limited to one growing season's lost production on the affected strip.



Impact on Registered Commercial Business — The alignment at km 31+800–31+840 partially affects the plot of ZAO "Asali Sari Khosor", a registered honey production business. The affected elements are a concrete foundation and metal perimeter fencing totalling 18.8 m², with a structure compensation value assessed at 7,596.91 TJS. The RP survey notes that no impact on business operations is anticipated given the limited extent of the take (15 m²); however, this assertion has not been supported by a formal income loss assessment in the survey data. Given that the entity is a registered ZAO rather than an informal household operation, EBRD ESR5 requires confirmation that: (i) the partial take does not physically constrain access to or operation of the facility; (ii) any temporary construction-phase disruption to access or operations is compensated; and (iii) the compensation assessed reflects full replacement cost. The RP team shall confirm whether an income loss assessment has been conducted and document the outcome before works commence at this location.

Irrigation Infrastructure Disruption — Nine of the 116 affected parcels are currently irrigated, with four reporting that the project will affect their irrigation access. Disruption to pipe-based irrigation systems during the growing season (April–September) can cause in-season crop losses that cannot be recovered. The alignment crosses multiple irrigation channels and gravity-fed intakes along the corridor.

Operational Phase

Permanent Reduction in Pasture Area — The permanent road formation and right-of-way reduces available communal grazing land by approximately 36.4 ha, the largest single land use impact by area. This is a long-term reduction in grazing range that affects livestock-dependent households, particularly in sections where terrain limits alternative pasture access.

Improved Market Access for Agricultural Produce and Quantified Time and Cost Savings (Positive) — Year-round reliable road access transforms the commercial viability of land-based livelihoods. Households currently unable to transport surplus produce to Baljuvon market due to seasonal road closures will gain consistent market access, directly increasing the economic value of existing agricultural land use and partially offsetting the impact of reduced pasture and lost tree assets over the medium term.

The RP Socio-economic Survey did not collect origin-destination data or trip frequency disaggregated by economic purpose, and the Project does not yet have a separate Transport Economic Appraisal. The figures below are indicative, drawing on baseline travel times documented in the Project feasibility study (PIURR, 2023), engineering assumptions for post-rehabilitation operating speeds, and value-of-time calculations using mean household income from the RP Socio-economic Survey (March 2026).

Three representative routes describe the corridor's economic geography: Baljuvon to Shahidon (km 0 to km 31), the heaviest-trafficked sub-section connecting outlying settlements to the only health and secondary-education facility along the corridor; Baljuvon to Sari Khosor (km 0 to km 56), the full corridor length; and Shahidon to upper valley (km 31 to km 56), where no formed road currently exists between km 36 and km 54.

Table 88: Baseline vs Post-Project Travel Times for Representative Routes

Route	Distance (km)	Baseline travel time	Post-project travel time (estimated)	Time saved (one-way)	Time saved (round trip)
Baljuvon to Shahidon	31	>2 hours (4WD, dry)	~45 minutes	~75 minutes	~2.5 hours
Baljuvon to Sari Khosor (full corridor)	56	>4 hours (4WD, dry); 5–6 hours (summer, civilian vehicle); impassable (winter)	~1.5 hours	~2.5 hours	~5 hours

Route	Distance (km)	Baseline travel time	Post-project travel time (estimated)	Time saved (one-way)	Time saved (round trip)
Shahidon to upper valley (Mullokoni)	25	>2 hours where passable; impassable km 36–54 in adverse conditions	~45 minutes	~75 minutes	~2.5 hours

Source: Baseline times from PIURR (2023) feasibility study and ESIA Section 5; post-project times estimated based on Category V design (6m paved carriageway) at average operating speed of ~40 km/h on mountain alignment.

In addition to time savings, the rehabilitation will reduce vehicle operating costs (VOCs) including fuel consumption, tyre wear, suspension and bodywork repair, and breakdown frequency. International evidence indicates that VOC on poor unpaved mountain roads is typically 2–3 times higher than on equivalent paved alignments, with the cost differential strongest for heavier freight vehicles and during wet-season conditions. The seasonal closure of the existing road also imposes significant indirect costs through deferred travel, perishable produce loss, and forgone economic activity that VOC measures alone do not capture.

The RP Socio-economic Survey recorded average household transport expenditure of 324 TJS per month (8.07% of total household expenditure), with aggregate transport spending of 31,770 TJS/month across the 98 surveyed households. The distribution of trips by economic purpose was not directly captured. Indicative trip-frequency assumptions for monetisation purposes are set out in Table 89. These should be validated through a corridor origin-destination survey prior to construction.

Table 89: Indicative Trip Frequency by Economic Purpose

Trip purpose	Indicative frequency (trips/month household) per	Notes
Market trips (buying inputs, selling produce)	4	Approximating one trip per week; subject to seasonal variation
Input deliveries / product transport	1–2	Higher for the 41 AHs reporting agriculture/livestock as an income source
Healthcare access	0.5–1	Higher for households with elderly or disabled members; emergency trips episodic
Education access	Term-time daily	School-age children at out-of-village schools, ~22 days/month during academic year
Employment / waged labour commute	5–10	Concentrated in households with members in formal salary employment (48 of 98 AHs)
Administrative services	0.5	Visits to Hukumat / Jamoat for documents, registrations

Source: ESIA team analysis based on RP SES (2026) and corridor settlement geography. Frequency assumptions are illustrative pending origin-destination survey.

Applying a value-of-time of 12.5 TJS/hour (50% of mean SES household hourly wage equivalent of ~25 TJS, reflecting a mix of business and personal travel purposes), and assuming an average of approximately 6 economic round-trips per household per month across the representative routes above, indicative annualised time-savings per household are in the order of 2,000–4,500 TJS, depending on settlement location relative to Baljuvon (lower for households in lower corridor sections, higher for upper-valley households where time savings per trip are greatest). Across the



corridor's estimated 779 households (6,000 residents at SES mean household size of 7.7), this implies aggregate annualised time-savings in the order of 1.5–3.5 million TJS (approximately 160,000–370,000 USD).

Vehicle operating cost reductions are additional to the time savings figures above. Applying a 30–50% reduction in per-kilometre VOC for paved-versus-unpaved operation against the 324 TJS/month average household transport spend yields indicative VOC savings of approximately 1,200–1,950 TJS per household per year, or 0.9–1.5 million TJS aggregate corridor savings (approximately 95,000–160,000 USD).

These estimates should be treated as indicative pending detailed transport economic appraisal. The exclusion of avoided perishable produce loss, forgone-trip costs during seasonal closure, and induced economic activity (which the Project is expected to generate) means total economic benefits will be materially higher than the figures above.

The RP Socio-economic Survey characterises current agricultural and livestock production along the corridor as predominantly subsistence-oriented. Fruit trees are recorded as non-commercial; livestock is kept primarily for household use, with only 11 of 62 livestock-keeping households reporting sale of live sheep, 9 of cattle, and minimal meat or animal-product sale. Trip frequency, transport cost per trip, volumes sold and farmgate prices were not captured in the SES. Indicative annualised earnings uplift attributable to improved road access is in the order of 1,000–3,000 TJS per agriculturally-active household, drawing on SES income data and the time and cost savings derived above. The principal mechanisms are reduced perishable produce loss, lower transport cost per consignment, and access to higher-priced Baljuvon and Bokhtar markets in place of localised low-volume buyers.

Cumulative Impacts

Tourism growth associated with improved access to Sari Khosor may increase demand for agricultural produce and create supplementary income opportunities for agricultural households. This is a positive cumulative dimension, though its scale depends on the rate of tourism development in the district.

Transboundary Impacts

No transboundary land use or livelihood impacts are anticipated.



7.12.4. Impact Summary and Assessment of Significance

Table 90 provides an assessment of the significance of potential land use and livelihood impacts before implementation of proposed mitigation measures.

Table 90: Impacts and Significance – Land Use and Livelihoods

Phase	Potential Impact	Receptors	No. Affected	Sensitivity	Public Concern	Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
Construction Phase												
C	Permanent partial land take — road widening removes strips of agricultural, residential, and orchard land. All 116 impacts are partial; no parcel is fully acquired. 22 parcels lose >20% of their plot.	116 DAPs across 56 km corridor	H	M	H	H	MOD	LT	INT	M	DEF	Medium
C	Loss of fruit trees and perennial crops — ~3,080 trees affected (2,943 productive fruit trees: apple, apricot, mulberry, walnut, quince, etc.). Fruit trees represent years of investment and are a primary long-term income and food security asset.	46 DAPs with trees; 55 HH households	H	H	H	H	MAJ	LT	INT	H	DEF	High
C	Loss of annual crops — vegetables (38 plots) and wheat affected. One growing season's production lost; most households can continue cultivation on unaffected portions of the same plot.	24 DAPs with annual crops	M	M	M	M	MOD	ST	SMA	M	DEF	Low-Med

Phase	Potential Impact	Receptors	No. Affected	Sensitivity	Public Concern	Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	Irrigation disruption — 9 irrigated parcels affected; 4 report project will affect irrigation access. Disruption during the growing season (April–September) risks in-season crop losses with no alternative supply.	9 irrigated parcels; 4 at risk of access loss	L	H	H	H	MOD	ST	SMA	H	POSS	Medium
Operational Phase												
O	Permanent reduction in pasture area — 36.4 ha of communal pasture lost along the corridor (66% of total affected area). Seasonal grazing range is reduced; 38 DAPs have no identified alternative land.	18 pasture parcels; livestock-dependent HHs	H	M	M	H	MOD	LT	INT	M	DEF	Medium
O	(+) Improved market access for agricultural produce — year-round reliable road access enables surplus crops, fruit, and livestock to reach Baljuvon market, directly increasing income potential for land-based livelihoods.	All corridor agricultural households; ~6,000 corridor residents	H	H	H	—	MAJ	LT	INT	H	DEF	High (+)

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minor / LT: Long term / MT: Medium Term / ST: Short term / SMA: Small / INT: Intermediate / EXT: Extensive / DEF: Definitely / POSS: Possible / UNLIKE: Unlikely. Phase: C = Construction; O = Operation.

7.12.5. Mitigation and Management Measures

Pre-Construction Phase

RP Finalisation and Compensation Before Works — Compensation for all affected land, trees, crops, and structures shall be agreed and paid to all 116 DAPs before construction commences on their parcels, in accordance with EBRD ESR5. No works shall commence on any parcel until compensation is completed for that parcel. The RP shall be finalised and approved by EBRD before construction mobilisation.

Land Acquisition Cut-Off Date — The RP cut-off date shall be formally communicated to all affected communities before finalisation. Assets established after the cut-off date are not eligible for compensation. Any parcels identified after the survey during detailed design shall be assessed and added to the RP.

Tree and Crop Compensation — All affected fruit trees shall be compensated at replacement cost, including an income supplement covering the period until replacement trees reach productive age (typically 3–7 years depending on species). Replacement trees shall be provided in addition to cash compensation where requested. Annual crop losses shall be compensated at market value for the affected season.

Irrigation Reinstatement — Existing irrigation infrastructure shall be mapped before works commence on each section. Planned disruption to irrigation shall avoid the growing season (April–September) where technically possible. All irrigation systems shall be reinstated to pre-construction standard before practical completion of the relevant section, with compensation payable for any in-season disruption. Where construction during the agricultural season is unavoidable, affected households shall be given a minimum of 72 hours advance notice before works commence on their parcel, in accordance with ESMP measure C-LU-01.

Livelihood Restoration for Severely Affected Households — The 22 parcels with >20% impact shall receive an individualised livelihood restoration assessment. Options may include replacement tree planting, agricultural inputs support, and skills or enterprise development support, as agreed with each affected household through the RP grievance and consultation process.

Construction Phase

Borrow Pit and Spoil Site Reinstatement — All temporary borrow pit and spoil disposal areas shall be reinstated to pre-construction land use capability on completion of their use, with topsoil stripped and stockpiled before excavation and replaced on reinstatement.

7.12.6. Residual Impacts

The following table provides an assessment of residual land use and livelihoods impacts following implementation of the mitigation measures described above.

Table 91: Residual Impacts – Land Use and Livelihoods

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
C	Permanent partial land take	Medium	Physical land is not recovered. For 22 severely affected parcels, a permanently reduced productive area remains. Compensation restores economic but not physical loss.	Low – Medium

C	Loss of fruit trees	High	A 3–7 year income gap remains while replacement trees mature. Income supplements reduce but do not eliminate hardship during this period.	Low – Medium
C	Loss of annual crops	Low – Medium	One season's loss compensated at market rates. No residual impact where cultivation continues on unaffected portions of the same plot.	Not Significant
C	Irrigation disruption	Medium	No residual impact where reinstatement is completed before the growing season. In-season losses on the 4 at-risk parcels require compensation if works extend into April–September.	Not Significant
O	Permanent pasture reduction	Medium	Approximately 36.4 ha of grazing land is permanently lost. Improved market access for livestock partially offsets the reduced grazing range.	Low – Medium
O	Improved market access	High (+)	Year-round connectivity delivers sustained long-term improvement in the economic value of land-based livelihoods across the full corridor.	High (+)

7.12.7. Monitoring

Monitoring of land use and livelihood impacts shall be undertaken as part of the Project ESMP monitoring programme. Requirements are summarised in Table 92. Detailed RP implementation monitoring requirements are set out in the RP Monitoring Framework.

Table 92: Monitoring – Land Use and Livelihoods

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Indicator
Construction Phase — RP Implementation Monitoring					
RP compensation delivery	Compensation agreements signed and payments made before works commence on each affected parcel; all 116 DAPs documented.	Pre-construction; updated quarterly.	All 116 affected parcels, 56 km corridor.	PIURR	RP implementation database; signed compensation agreements. Quarterly report to EBRD.
Tree and crop compensation	Replacement trees provided and/or cash compensation paid for all 3,080 affected trees; crop compensation paid for all 24 annual crop DAPs before the relevant construction season.	Pre-construction on each section; verified at works commencement.	46 DAP parcels with trees; 24 with crops.	PIURR; SCLO.	Compensation register cross-checked against RP asset inventory. Any outstanding payments flagged to Engineer before works commence.

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Indicator
Irrigation reinstatement	Irrigation access confirmed restored to pre-construction standard for all 4 at-risk parcels; no growing-season disruption without compensation.	On completion of works in each irrigation-affected section.	9 irrigated parcels; 4 at-risk of access disruption.	Contractor ESHS Manager; PIURR.	Before/after photos; PAP written confirmation of restoration. Any growing-season disruption triggers immediate alternative supply and compensation.
Operational Phase					
Livelihood restoration monitoring	Income recovery for severely affected households (>20% plot impact); uptake of replacement tree planting; agricultural productivity of affected plots.	Annual: years 1 and 3 post-construction.	22 severely affected DAPs (>20% plot loss).	PIURR	Household income survey (targeted). Replacement tree survival rate. Reported in semi-annual ESMR to EBRD.

In line with EBRD ESR6, the assessment considered the Project's effects on priority ecosystem services — that is, those services over which the Project has control or influence and which are either (i) directly relied upon by affected communities for their livelihoods, or (ii) important to the performance of the Project or to the maintenance of the biodiversity features identified in the Critical Habitat Assessment. Given the rural, agro-pastoral character of the corridor, the relevant services are predominantly *provisioning* and *cultural*, with a smaller set of *regulating* and *supporting* services linked to the river corridor and surrounding slopes.

The principal provisioning services are land-based and are well characterised in the socio-economic baseline prepared for the Resettlement Plan (RP). Affected households depend on cultivated agricultural land and rain-fed annual cropping (notably wheat, grown by 23 households on affected parcels), orchards and fruit-bearing trees, timber trees and saplings, and pasture/grazing land. Livestock-keeping is an important, largely subsistence-oriented component of household livelihoods, reported by 62 of the 98 surveyed households (predominantly poultry, cattle, donkeys and sheep), and agriculture/livestock is a primary income source for around 40% of surveyed households. A significant share of agricultural use is on land leased from the Forestry Department (43 of the 62 affected agricultural plots) for cultivation, orchards and grazing, underlining the close link between the local forestry estate and household provisioning.

The Project's residual impacts on these provisioning services are partial losses of land and productive assets rather than landscape-scale loss of the services themselves, and they are addressed through the RP under ESR5 — full replacement-cost compensation, provision of alternative or adjusted leased plots, and targeted livelihood restoration and vulnerable-household measures designed to ensure that affected persons are no worse off and, where possible, better off. No priority provisioning service is rendered unavailable to the wider community as a result of the Project.

Two ecosystem services of wider, more-than-local significance are also engaged. First, the corridor and surrounding Hazratishoh foothill woodland support *genetic resources* in the form of crop wild relatives — the Critically Endangered wild pears *Pyrus tadshikistanica* and *P. korshinskyi* and the wild apple *Malus sieversii* — whose conservation value is a globally important supporting/provisioning service. These features carry Net Gain (Critical Habitat) and No Net Loss obligations and are managed



through the Biodiversity Action Plan (BAP) and the associated Biodiversity Offset Programme, including propagation and stewardship delivered with a regional botanic-garden initiative. Second, the Sari Khosor Natural Park and the surrounding landscape provide *cultural services* (recreation, tourism and conservation value, including the Bukhara Deer breeding facility at Dashtaro); the improved road is expected to increase visitor pressure, and these induced effects are managed through the measures set out for the Park and in the ESMP/BMP.

Regulating and supporting services on the steep valley slopes and along the Shurobdaryo (slope stabilisation and erosion control by vegetation, riparian and water-regulation functions, and pollination) are maintained through the mitigation hierarchy embedded in the design and the BMP — riparian no-go buffers, slope and drainage controls, reinstatement of cleared ground, and the seasonal in-river works restriction protecting the Amu Darya trout spawning migration. On this basis, the Project is not expected to cause a net loss of any priority ecosystem service, with provisioning-service impacts compensated under ESR5 (RP) and biodiversity-linked services secured under ESR6 (BAP/BMP and the Biodiversity Offset Programme).

7.13. Gender and Vulnerable People

This section assesses the differential impacts of the BSK Project on population groups with distinct gender-related and socio-economic vulnerabilities. The baseline (Section 6.3) identifies female-headed households (FHHs, 15% of DAPs), large families (17%), low-income households (6%), households with disabled members (6%), and elderly-headed households (21% of household heads aged 60+) as the principal vulnerability categories among the 116 directly affected parties. Thirty-four per cent of DAPs carry at least one vulnerability flag; nine carry two or more simultaneously. Access to health services and secondary education is constrained by geographic isolation in ways that affect women and girls differently. The project's operational phase delivers substantial gender-differentiated benefits — principally improved healthcare access for upper-valley women — which are assessed alongside risks.

7.13.1. Project Activities with Potential to result in impacts on gender and vulnerable people

- Land acquisition and temporary land take — affecting 17 FHHs and 20 large family households whose greater land dependence makes partial land take disproportionately impactful.
- Restriction and temporary closure of the only corridor road — no alternative route exists; every closure affects all residents' access to healthcare, education, markets, and services.
- Construction camp establishment and workforce mobilisation — non-local male workforce in remote communities introduces SEA/SH risk (addressed in Section 7.15).
- Earthworks and drainage works in settlement areas — disrupting irrigation channels and piped water supply in ways that disproportionately affect women managing household water and agricultural production.
- Construction employment and local procurement — presenting potential benefit for corridor communities, including women, subject to proactive outreach.

7.13.2. Sensitive Receptors

Female-headed households (FHHs) — 17 of 116 DAPs (15%), majority widows or women whose husbands work outside the district. At greatest risk of exclusion from compensation processes and of disproportionate impact from partial land take.

Women of reproductive age, upper valley (km 36–56) — Approximately 1,500 residents in communities where no formed road currently exists. Obstetric emergencies requiring rapid transfer to Shahidon hospital (km 31) are currently constrained or impossible during adverse weather. The most acute gender-differentiated vulnerability in the baseline.



Girls in corridor communities — Poor road access is a documented barrier to girls' secondary school attendance in rural Tajikistan. Schools at km 31, km 41, and km 46 are the critical facilities. The pedestrian bridge at Aspiringon (km 41) currently requires a river crossing for eastern-bank communities.

Large family households — 20 DAPs (17%), mean 5.8 children under 18, mean household size 12.1 persons, mean 2.7 working members. High dependency ratio amplifies per-capita impact of land take or income disruption. High number of children in settlement areas elevates construction safety exposure.

Low-income households — 7 DAPs (6%), mean monthly income ~3,026 TJS against survey mean of 8,686 TJS. Minimal financial reserves to absorb income disruptions or delays in RP compensation. A further 12 households (10%) receive state social assistance.

Households with members with disabilities — 7 DAPs (6%). Heightened barriers to consultation participation, compensation access, and adaptation to disruption. Face particular risk from construction access restrictions and from increased vehicle speeds in operation.

Elderly-headed households — 21% of household heads aged 60 or over (4 aged 70+). Reduced physical capacity, more frequent healthcare needs, greater difficulty navigating administrative processes. Heightened road safety risk in operation.

7.13.3. Potential Impacts

Construction Phase

Disproportionate Livelihood and Compensation Impacts on FHHs — FHHs are more sensitive to partial land take, crop loss, and tree loss than male-headed households.

Exclusion from Consultation, Compensation, and Grievance Processes — Standard community consultations through male-dominated public meetings leave women, elderly-headed households, and disabled household members underrepresented. Consequences include RP entitlements not reaching FHHs, construction impacts on vulnerable households not captured by the GRM, and failure to provide differentiated support to multi-flag households.

Healthcare Access Disruption — Construction road closures on the only access route risk delaying obstetric emergency transfers for upper-valley women, where baseline access is already severely constrained. Time-critical medical emergencies — haemorrhage, eclampsia, complicated delivery — are incompatible with extended road closures without a dedicated emergency access protocol. Elderly and disabled residents face equivalent risk from delayed ambulance or evacuation access.

Differential Burden on Women and Caregivers — Dust, noise, disrupted water supply, and restricted access to agricultural land fall disproportionately on women managing household water, food production, and childcare. Irrigation and piped water disruption has the most direct effect: any interruption requires manual collection from alternative sources, increasing women's time and physical burden significantly.

Operational Phase

Improved Emergency Healthcare Access (Positive) — Year-round paved access to Shahidon hospital (km 31) — the only confirmed inpatient facility along the 56 km corridor — resolves the most acute gender-differentiated baseline vulnerability for the estimated 6,000 residents of the 19 settlements along the alignment, and supports onward referral access to district-level facilities at Baljuvon for the wider ~30,000-person district catchment. Approximately 1,500 women of reproductive age in the upper valley (km 36–56), for whom obstetric emergency transfers are currently constrained or impossible during adverse weather, are the most acute beneficiaries. Within the directly affected population (DAP), benefits accrue to 17 FHHs (~119 persons), 24 elderly-headed households (21% of HoHs), 7 households with a member with a disability, and 7 low-income households.

Improved Educational Access (Positive) — Year-round road access and the Aspiringon pedestrian bridge (km 41) reduce the physical barrier to school attendance — particularly girls' secondary attendance — for school-age children across the corridor. Children under 18 represent 37.3% of the corridor population, equivalent to roughly 2,200 school-age children across the 19 settlements served by five confirmed schools (secondary at Shahidon, Khorma, Doshmandi, Aspiringon, Peshtova; elementary at Toidara, Chiltori, Dashti Kilko). Upper-valley communities beyond km 36 — currently lacking a formed road — gain reliable year-round access. Within the DAP, this benefits children in 17 FHHs, 20 large families (mean 5.8 children under 18), 7 disabled-member households, and 7 low-income households.

Improved Market Connectivity and Economic Participation (Positive) — Reliable access to Baljuvon connects 18 outlying settlements in Sari Khosor Jamoat to district markets and administrative services. Indicative travel-time savings for the round trip from upper-valley settlements to Baljuvon are in the order of 5 hours, with associated indicative annualised time and vehicle-operating cost savings of 3,000–6,000 TJS per household — disproportionately benefiting the 17 FHHs and 20 large families whose travel cost burden is highest relative to income (full quantification in Section [Land Use & Livelihoods, Improved Market Access]). Of the 98 directly affected households, 41 report agriculture or livestock as a source of income, 17 are female-headed and more dependent on land productivity, and 20 are large families with high dependency ratios. Indicative annualised earnings uplift attributable to improved market access is in the order of 1,000–3,000 TJS per agriculturally-active household, with disproportionate benefit to FHHs given their concentrated dependence on land-based income; figures are indicative pending a targeted livelihoods baseline survey. Tourism growth associated with Sari Khosor access may create service-sector employment accessible to women, with 12.5% of female SES respondents specifically identifying tourism as a livelihood opportunity.

Beneficiary numbers are presented in Table 90 below, disaggregated by jamoat and by vulnerable category. DAP-level figures are drawn directly from the RP Socio-economic Survey (March 2026); corridor and district catchment figures are PIURR/feasibility-study estimates. Settlement-level disaggregation beyond affected-parcel distribution (Table 38) is not available from existing baseline surveys.

Table 93: Operational-phase beneficiaries by subsection, jamoat and vulnerable category

Benefit	Total beneficiary base	Baljuvon Jamoat	Sari Khosor Jamoat	FHHs	Large families	Low-income	Disability	Elderly - headed
Healthcare access (emergency referral to Shahidon hospital; onward to Baljuvon district care)	~6,000 corridor residents; ~30,000 district catchment; ~1,500 women of reproductive age in upper valley	1 settlement (Baljuvon)	18 settlements	17 (~119 persons)	20	7	7	24
Educational access (5 confirmed schools along corridor; Aspiringon pedestrian bridge)	~2,200 school-age children in corridor (37.3% of 6,000)	Baljuvon — district referral school	18 settlement; upper valley gains year-round access	17 (school-age children within)	20 (mean 5.8 children <18)	7	7	n/a

Market connectivity (Baljuvon market and administrative centre; through-corridor to Bokhtar / Dushanbe)	~6,000 corridor residents; 41 AHs with agriculture/livestock income; potential tourism employment	Baljuvon — destination market	18 settlements gain reliable access	17 (greater farm-income dependence)	20	7	7	24
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Source: RP Socio-economic Survey, March 2026; PIURR catchment estimates; ESIA team analysis.

Road Safety Risks for Children, Elderly, and Disabled Road Users — Increased vehicle speeds on the paved road create elevated risk for the slowest and least mobile road users. Children from large family households, elderly-headed households, and disabled community members face disproportionate exposure. This is the distributional dimension of the general road safety impact assessed in Section 7.14.

Cumulative Impacts

Tourism growth and induced economic development may benefit better-positioned households more than vulnerable ones. Sustained monitoring of gender-disaggregated outcomes in the operational phase is required to confirm equitable benefit distribution.

Transboundary Impacts

All activities are within Tajikistan. No transboundary gender or vulnerable people impacts are anticipated.



7.13.4. Impact Summary and Assessment of Significance

Table X provides an assessment of the significance of potential gender/vulnerable people impacts before implementation of the proposed mitigation measures. Impact significance is assessed based on the magnitude of the potential impact, the sensitivity of receptors, the spatial scale, timeframe, and probability of the impact occurring.

Table 94: Impacts and Significance – Gender and Vulnerable People

Phase	Potential Impact	Receptors	No. Affected	Sensitivity	Public Concern	Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
Construction Phase												
C	Disproportionate impacts on FHHs — 17 FHHs (15% of DAPs) have fewer working members and greater land dependence. Compensation processes defaulting to male household heads risk missing FHH assets or misdirecting payments.	17 FHHs (~119 persons)	M	H	M	H	MOD	MT	SMA	H	POSS	Medium
C	Exclusion from consultation and GRM — standard consultations favour male household heads. Women, elderly, and disabled household members may miss RP entitlements and have limited GRM access.	FHHs; elderly; disabled HHs; women across corridor	M	H	M	H	MOD	ST	SMA	H	POSS	Medium
C	Healthcare access disruption — road closures delay emergency transfers to Shahidon hospital (km 31). Obstetric emergencies in	Women of reproductive age, upper valley; elderly; disabled	M	H	H	H	MAJ	ST	SMA	H	POSS	High

Phase	Potential Impact	Receptors	No. Affected	Sensitivity	Public Concern	Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	the upper valley (km 36–56) are time-critical; any closure without an emergency access protocol is potentially life-threatening.											
C	Differential burden on women — water supply disruption, dust, and restricted land access fall disproportionately on women managing household water, food production, and childcare.	Women across 19 corridor settlements	H	M	M	M	MOD	ST	INT	M	DEF	Low-Med
C	Girls' school access — construction near schools at km 31, 41, and 46 restricts access. Poor physical access is a risk factor for girls' dropout in Tajikistan; temporary disruption risks becoming permanent.	Girls in corridor communities; 3 schools	M	H	M	M	MOD	ST	SMA	M	POSS	Medium
Operational Phase												
O	(+) Improved healthcare access — year-round road access to Shahidon hospital resolves the most acute gender-differentiated baseline vulnerability. Obstetric emergency transfers from the upper valley become reliable. Elderly and	Women of reproductive age, upper valley; elderly; disabled	H	H	H	—	MAJ	LT	INT	H	DEF	High (+)

Phase	Potential Impact	Receptors	No. Affected	Sensitivity	Public Concern	Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	disabled residents benefit equally.											
O	(+) Improved educational access — year-round road and Aspiringon pedestrian bridge (km 41) reduce the physical barrier to girls' secondary schooling in the upper valley.	Girls and boys, upper valley; school-age children across corridor	H	H	H	—	MAJ	LT	INT	M	DEF	Med-High (+)
O	(+) Improved market access — reliable access to Baljuvon enables women and FHHs to sell produce. Tourism growth may create service-sector employment accessible to women.	Women; FHHs; corridor communities	H	M	M	—	MOD	LT	INT	M	DEF	Medium (+)
O	Road safety — vulnerable road users — higher vehicle speeds elevate risk for children, elderly (21% of heads aged 60+), and disabled road users. Distributional dimension of the general road safety impact (Section 7.14).	Children; elderly; disabled; 19 settlements	H	H	H	H	MAJ	LT	INT	H	DEF	High

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minor / LT: Long term / MT: Medium Term / ST: Short term / SMA: Small / INT: Intermediate / EXT: Extensive / DEF: Definitely / POSS: Possible / UNLIKE: Unlikely. Phase: C = Construction; O = Operation.



7.13.5. Mitigation and Management Measures

Pre-Construction Phase

Gender Action Plan (GAP) — PIURR shall prepare a GAP as an ESMP sub-plan, submitted to EBRD before mobilisation. The GAP shall cover: targeted engagement protocols for FHHs; gender-disaggregated monitoring indicators; women's employment outreach; and coordination with the Women's Committee of Khatlon Region.

Vulnerability Register — PIURR shall establish and maintain a Vulnerability Register for all 40 vulnerable DAP households, recording vulnerability categories, RP entitlements, accommodation requirements, and outstanding actions. Updated at each quarterly RP monitoring cycle.

Accessible Consultation and GRM — Separate women's consultation sessions shall be held in each settlement before construction and quarterly thereafter, facilitated by at least one female SCLO. GRM materials shall be available in Tajik and Russian in accessible non-text formats. The SEA/SH reporting channel shall be communicated to women in every settlement.

Construction Phase

Emergency Medical Access Protocol (EMAP) — Prepared as a component of the TMP for each work zone before works commence on any section. The EMAP shall provide for: immediate road clearance on confirmed emergency dispatch; a 24-hour work zone emergency contact; an emergency passing bay at all active work zones; and pre-notification of Shahidon hospital before nearby works commence. All EMAP activations recorded and reported to the Engineer within 24 hours.

School Access Management — The Contractor shall agree construction scheduling, safe pedestrian routes, and heavy vehicle restrictions during school hours with each school's head teacher before works commence nearby. An alternative safe river crossing shall be maintained for eastern-bank school children during Aspiringon bridge construction.

Women's Employment Outreach and Female SCLO Staffing — The LMP shall include a target for female participation in unskilled and support roles. The SCLO team shall include at least one female member who leads all women's consultations and FHH outreach, and serves as a community contact point for SEA/SH concerns.

Water Supply Disruption Management — Irrigation channels and water supply pipelines shall be mapped before construction in each settlement zone. Planned disruption to irrigation shall avoid the growing season (April–September) where possible. Temporary alternative water supply shall be provided within 24 hours of any unplanned supply interruption.

Vulnerable Household Outreach — The SCLO shall visit all 40 Vulnerability Register households on construction commencement in their area and at intervals of not more than three months, confirming compensation access, GRM awareness, and any emerging impacts. All planned access restrictions affecting Vulnerability Register households shall be communicated with a minimum of 48 hours advance notice, consistent with the general access restriction standard set out in the ESMP Community Health and Safety Plan. Cases requiring additional support escalated to PIURR within 48 hours.

Operational Phase

Road Safety Infrastructure for Vulnerable Users — Physical calming measures shall be prioritised at school frontages (km 31, km 41, km 46) and at the Aspiringon bridge approach, as locations of highest vulnerable-user concentration.

Gender-Disaggregated Benefit Monitoring — PIURR shall include gender-disaggregated indicators in the operational monitoring programme. Where monitoring indicates that benefits are not reaching



vulnerable groups equitably, PIURR shall convene a review with the Women's Committee of Khatlon Region.

7.13.6. Residual Impacts

The following table provides an assessment of residual impacts following implementation of the mitigation measures described above.

Table 95: Residual Impacts – Gender and Vulnerable People

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
C	FHH livelihood and compensation impacts	Medium	No material residual risk remains with individual SCLO consultation and the Vulnerability Register maintaining oversight of all FHH cases throughout construction.	Not Significant
C	Exclusion from consultation and GRM	Medium	No material residual exclusion risk with mandatory separate women's sessions, female SCLO presence, and accessible GRM formats in place.	Not Significant
C	Healthcare access disruption	High	Residual risk remains for extended closures in the upper valley — unavoidable in a narrow mountain corridor. The EMAP reduces but cannot eliminate this risk.	Low – Medium
C	Differential burden on women	Low – Medium	No material residual burden with priority water supply management and SCLO outreach to all Vulnerability Register households in place.	Not Significant
C	Girls' school access	Medium	No material residual access risk with school access management plans, heavy vehicle restrictions during school hours, and maintained pedestrian detour routes in place.	Not Significant
O	Healthcare access (+)	High (+)	Year-round access delivers a sustained positive impact throughout the operational life.	High (+)
O	Educational access (+)	Medium – High (+)	Year-round road and Aspiringon pedestrian bridge deliver a sustained access benefit; girls' enrolment monitored where data available.	Medium – High (+)
O	Market access (+)	Medium (+)	Improved connectivity delivers a sustained positive impact for women and FHHs across the corridor.	Medium (+)
O	Road safety — vulnerable road users	High	Residual risk reduced through physical calming, speed restrictions, and pedestrian infrastructure. Before-and-after speed	Low – Medium

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
			studies provide the adaptive management trigger if controls prove insufficient.	

Note: For positive impacts (marked "+"), the residual significance is shown as equal to the pre-mitigation rating. This reflects standard ESIA practice — the mitigation hierarchy applies to negative impacts (where the objective is to reduce significance), not to positive impacts (where the benefit is preserved at its assessed magnitude). Where the project includes specific enhancement measures that materially increase the positive effect, the residual rating is shown as higher than the pre-mitigation rating.

7.13.7. Monitoring

Monitoring of impacts shall be undertaken per the Project ESMP monitoring programme. Requirements are summarised in the table below.

Table 96: Monitoring – Gender and Vulnerable People

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Indicator
Construction Phase					
Gender-disaggregated RP monitoring	Compensation received by FHH heads; FHH participation in consultations; Vulnerability Register updated; SCLO outreach outcomes for all 40 vulnerable households.	Quarterly; triggered by any FHH complaint.	All 116 DAPs; Vulnerability Register households.	PIURR Social Safeguards Officer; SCLO.	RAP monitoring database; SCLO visit records. Quarterly report to EBRD.
Women's consultation participation	Number of women attending gender-specific sessions by settlement; issues raised by women in GRM.	Per consultation event; quarterly summary.	All 19 settlements.	SCLO (female staff member).	Sex-disaggregated attendance registers; GRM issue log. Missed settlement sessions followed up within 30 days.
Emergency medical access events	EMAP activations; TMP supervisor response times; complaints relating to delayed medical access.	Continuous; monthly summary; immediate reporting of any EMAP activation.	All active work zones, 56 km corridor.	Contractor ESHS Manager; TMP supervisors.	EMAP incident register. Any activation reported to PIURR and EBRD within 24 hrs.
School access management	Safe pedestrian access routes maintained; heavy vehicle restrictions during school hours observed; awareness sessions delivered.	Daily inspection near each school; weekly ESHS report.	Shahidon (km 31), Aspiringon (km 41), Peshtroba (km 46).	Contractor ESHS Manager; SCLO.	School access inspection log; heavy vehicle records; session attendance confirmed by head teacher.

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Indicator
Vulnerable household outreach	SCLO visits completed for all 40 Vulnerability Register households; issues identified and escalation actions taken.	Individual visits ≤3 months; triggered by any VR household GRM complaint.	40 Vulnerability Register households.	SCLO; PIURR for escalations.	SCLO visit records. Issues escalated to PIURR within 48 hrs. Quarterly report to Engineer.
Operational Phase					
Road safety — vulnerable users	Casualties involving children, elderly, or disabled road users; GRM road safety complaints; before/after speed study results at settlement locations.	Annual; immediate review on any casualty involving vulnerable road user.	All 19 settlements; priority at school frontages and Aspiringon bridge approach.	PIURR / Road Operator; Traffic Police.	Casualty register disaggregated by age/vulnerability. Speed study results vs 40 km/h target. Semi-annual ESMR to EBRD.
Gender-differentiated benefit monitoring	Emergency medical transfers from upper valley (healthcare access proxy); girls' school enrolment (where available from jamoat records); female participation in road-related employment.	Annual: years 1, 2, 3, and 5 post-opening.	Upper valley (km 36–56) for health/education; all corridor for employment.	PIURR; coordination with District Health and Education authorities; SCLO.	Jamoat health and education records; employment survey. Gender-disaggregated reporting in semi-annual ESMR to EBRD.

7.14. Community Health and Safety

This section assesses the potential community health and safety (CHS) impacts of the BSK project, other than issues addressed in dedicated sections elsewhere in this ESIA — noise and vibration, air quality, flooding and natural hazards, and water quality are covered in their respective physical environment sections. The focus here is on the risks that arise from the direct interface between the project — its construction workforce, its plant, its works programme, and the improved road itself — and the approximately 19 communities along the alignment. The detailed management requirements are set out in the Community Health and Safety Plan (Annex 2 of the ESMP), to which this section refers throughout.

7.14.1. Project Activities with Potential to result in community health and safety impacts

The following project activities are the principal sources of community health and safety risk:

- Movement of heavy construction vehicles and plant through settlements along the alignment, including on public roads that are shared with pedestrians, children, cyclists, and livestock.
- Maintenance of open excavations, borrow pits, spoil sites, and construction work fronts adjacent to or accessible from communities — presenting physical hazard to community members and particularly to children.



- Temporary road closures, diversions, and restrictions on access to farms, irrigation channels, schools, and medical facilities during construction works.
- Introduction of a non-local construction workforce into a remote mountain valley community, with the associated risks of labour influx — social conflict, pressure on local resources, communicable disease, and sexual exploitation and abuse (SEA/SH).
- River corridor works with potential to disrupt water supplies, irrigation channels, and access routes for downstream communities.

7.14.2. Sensitive Receptors

The key sensitive receptors for community health and safety impacts are:

- Residents in all settlements along the corridor — whose daily lives, movement patterns, and access to services are directly affected by construction activity on the road that runs through or adjacent to their communities.
- Children and school pupils — several schools are located along the corridor, with buildings and play areas adjacent to or directly accessible from the road. Children present on the road surface before and after school are the highest-risk pedestrian category for construction and operational traffic.
- Medical facilities — health clinics along the corridor serve communities that may have no alternative access to healthcare. Any disruption to access at these facilities is disproportionately consequential.
- Dehkan farmers and irrigation-dependent households — whose livelihoods depend on access to agricultural land and water infrastructure that may be temporarily disrupted by construction.
- Women and girls — who face elevated risk from the presence of a predominantly male non-local workforce in a remote setting, particularly in relation to SEA/SH.
- Road users — the existing road serves as the primary access route for communities throughout the corridor. Seasonal isolation due to floods, snow, and landslides is already a baseline condition; construction works add a further constraint on the reliability and safety of access.

7.14.3. Potential Impacts

Construction Phase

Traffic Accidents and Community Safety - The construction of the road requires substantial volumes of heavy vehicle movements — earthmoving equipment, material delivery trucks, fuel tankers, water bowlers, and concrete mixers — operating on or adjacent to a public road through settlements where pedestrians, children, livestock, and cyclists share the same carriageway. Many of the settlements along the BSK corridor are ribbon developments strung directly along the road with no separation between residential frontages and the carriageway. Children play at the roadside, residents cross frequently, and livestock move freely.

The introduction of heavy vehicles at construction traffic volumes into this environment creates a materially elevated risk of serious injury to community members. The risk is highest at settlement entry and exit points where construction vehicles accelerate or decelerate, at school start and finish times, and during material haulage operations on haul routes that pass through settlements. The confined valley geometry and narrow haul routes through villages further limit the ability to manage speed and separation.



Open Excavations and Site Hazards - Culvert replacement, drainage works, borrow pit operations, and general earthworks create open excavations, unstable slopes, and unsecured construction materials that present a physical hazard to any community member — and particularly to children — who enters a work area. In rural Tajikistan, where children range freely and there is no established culture of site security fencing, the risk of community members accessing active construction sites is real. Borrow pits present a particular secondary hazard: after extraction ceases, pits can fill with water and become drowning hazards, especially for children and livestock.

Access Disruption - The construction programme will require periodic closures or restrictions of the road and associated tracks. For communities that already experience seasonal isolation and depend on the road for access to healthcare, education, markets, and administrative services, any additional restriction on access — even temporary — has the potential to cause disproportionate harm. Disruption to irrigation channels and agricultural access tracks during earthworks can have direct livelihood consequences, particularly if it occurs during the irrigation season.

Labour Influx - The construction workforce for a project of this scale in a remote mountain corridor will include a significant proportion of non-local workers. The introduction of non-local workers into small, close-knit communities with limited absorption capacity can generate a range of social tensions: competition for local services and resources, cultural and behavioural frictions, and the economic and social disruption associated with a temporary, predominantly male workforce in a community where such presence is unusual. The BSK corridor communities are predominantly subsistence agricultural households with limited non-farm employment — they have not been previously exposed to large construction workforce influx in this valley.

SEA/SH - Sexual exploitation and abuse and sexual harassment (SEA/SH) are a recognised risk on road construction projects involving non-local workforces in remote communities. The risk arises from the combination of a predominantly male, non-local workforce separated from their normal social environment and accountability structures, operating in communities where women and girls may have limited voice and recourse, and where power asymmetries between workers and community members can be exploited. In the BSK corridor, additional risk factors include the remote and isolated setting, limited local law enforcement capacity, and the absence of established NGO or civil society networks that might provide community-level support to survivors.

Communicable Disease - The risk of HIV and other sexually transmitted infections is a standard labour influx concern given the demographics of a construction workforce. In the context of this project, the risk is assessed as lower than in comparable projects in higher-prevalence settings, reflecting the rural and socially conservative character of the corridor communities and the relatively limited scale of worker influx anticipated. Standard awareness and health promotion measures are nonetheless required.

Cumulative and Transboundary Impacts

No significant cumulative community health and safety impacts beyond those assessed in this section and the Road Safety section have been identified. The BSK corridor is remote and there are no other major construction projects in the valley that would interact with construction-phase community safety risks. No transboundary community health and safety impacts are anticipated.



7.14.4. Impact Summary and Assessment of Significance

Table 97 provides an assessment of the significance of potential community health and safety impacts before implementation of the proposed mitigation measures.

Table 97: Impacts and Significance – Community Health and Safety

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
Construction Phase												
C	Labour influx tensions — social conflict, pressure on community services, and community-worker frictions arising from introduction of non-local workforce into small, close-knit rural communities	Host communities in corridor settlements; workers	H	M	M	M	MOD	ST	INT	M	POSS	Medium
C	SEA/SH — risk of sexual exploitation, abuse, and harassment by construction workers affecting community members (especially women and girls) and female	Women and girls in corridor communities; female workers	M	H	H	H	MAJ	ST	SMA	H	POSS	Medium

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	workers, elevated by non-local male workforce in isolated communities with limited local accountability structures											
C	Communicable disease — transmission of HIV/AIDS, TB, and other communicable diseases between workforce and local communities through labour influx and worker-community interaction	Communities along corridor; construction workers	M	M	M	M	MOD	ST	INT	M	POSS	Low

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minor / LT: Long term / MT: Medium Term / ST: Short term / SMA: Small / INT: Intermediate / EXT: Extensive / DEF: Definitely / POSS: Possible / UNLIKE: Unlikely. Phase: C = Construction; O = Operation.



7.14.5. Mitigation and Management Measures

The detailed community health and safety management requirements are set out in the Community Health and Safety Plan (Annex 2 of the ESMP) and the Traffic Management Plan (Annex 3 of the ESMP). This section summarises the principal measures by impact type.

Pre-Construction Phase

Before construction commences in each section, the Contractor shall hold a community briefing covering the scope and timing of works, expected impacts on traffic and access, the mitigation measures in place, and how to raise a complaint through the Grievance Redress Mechanism. All irrigation channels and community water systems within the project footprint shall be identified and mapped by the SCLO in consultation with affected communities. Alternative access routes shall be confirmed and agreed with communities and the Engineer before any works that will affect access begin. The Social and Community Liaison Officer (SCLO) shall be in post, with contact details published on site notice boards and community display boards in Tajik, before any works commence.

Construction Phase

Traffic Safety in Settlements — Speed limits within all settlements are enforced through physical speed calming measures and flaggers, not signage alone. Flaggers are stationed at both the entry and exit points of each settlement during heavy vehicle movements, not only at active works locations. Dedicated crossing marshals are deployed at school entry and exit points during school start and finish times. Reversing of heavy vehicles in settlements is minimised and requires a banksman at all times. No heavy vehicle movement through settlements is permitted between 22:00 and 06:00 without specific Engineer approval and advance community notification. Any vehicle involved in an incident involving a community member is immediately reported to the ESHS Manager and Engineer regardless of apparent severity. Zero-tolerance applies to speeding through settlements, failure to deploy flaggers at active works, and leaving open excavations unfenced overnight adjacent to residential areas.

Construction Site Security — All open excavations are fenced before the end of each working day. Borrow pits, spoil sites, and construction work fronts adjacent to settlements are physically secured against unauthorised access with gates, fencing, and clearly visible signage in Tajik and Russian. Security patrols are deployed at active sites adjacent to settlements, with particular attention to children's play areas and school access routes.

Access Continuity — Safe and continuous access to all settlements and their facilities is maintained at all times throughout construction. Alternative routes are confirmed before any disruption begins. A minimum of 72 hours' advance notice is given to affected communities before any planned road closure or access restriction, in accordance with ESMP measure C-TM-03. Emergency vehicle access is maintained through all active works sections at all times. All irrigation channels and agricultural access infrastructure damaged during construction is repaired within 24 hours of identification, and affected users are notified within 24 hours of any interruption.

Labour Influx Management — The construction workforce is housed in designated camps that provide all food, water, sanitation, and services, maintaining worker self-sufficiency and minimising competition for local community resources. Workers are not permitted to establish informal accommodation in community residential areas. The full labour influx management framework is set out in the Labour and Working Conditions Management Plan (Annex 9 of the ESMP).

SEA/SH Prevention and Response — All Contractor and subcontractor personnel sign the Project Code of Conduct (Annex 12 of the ESMP) before commencing work — signing is a condition of employment. The Code is explained at induction in Tajik and Russian rather than simply distributed. SEA/SH prohibitions and reporting channels are reinforced at monthly toolbox talks. SEA/SH reporting channels — including confidential channels accessible to community members, not only workers —

are communicated to communities by the SCLO at the start of works in each area. All SEA/SH cases are handled under survivor-centred protocols: confidentiality, safety, non-discrimination, and respect for survivor choices are paramount. Allegations are reported to PIURR within 24 hours under the agreed confidentiality protocol and investigated through the formal GRM process.

Communicable Disease — A mandatory HIV/STD awareness programme is delivered to all workers within two weeks of mobilisation and repeated bi-monthly throughout construction, in accordance with ESMP measure C-LB-04. Camp health provisions and health screening requirements are maintained throughout the construction period.

Operational Phase

Operational community health and safety risks — principally road safety for pedestrians, school children, and road users — are addressed in the Road Safety section of this ESIA and are not repeated here.

7.14.6. Residual Impacts

Table 98 summarises residual community health and safety impacts following implementation of the mitigation measures described above and in the ESMP.

Table 98: Residual Impacts – Community Health and Safety

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
C	Traffic accidents	Medium	Residual accident risk cannot be eliminated given the volume of heavy vehicles on a narrow mountain alignment, but systematic controls will reduce frequency and severity.	Low
C	Injuries from open excavations and construction sites	Medium	Residual risk of public access to hazardous areas is low with daily fencing, physical security, and active supervision near settlements.	Low
C	Access disruption	Medium	All disruptions are planned, communicated in advance, and mitigated before they occur. Residual impact is inherent to construction on the only access route.	Low
C	Labour influx	Medium	No material residual impact with worker self-sufficiency maintained through camps and the social management framework in place.	Not Significant
C	SEA/SH	Medium	Cases cannot be entirely prevented but the reporting and response framework ensures any incidents are handled appropriately.	Low
C	Communicable disease	Low	No material residual transmission risk with bi-monthly awareness programme,	Not Significant

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
			camp health provisions, and health screening in place.	
O	Operational road safety and community access	—	Assessed in the Road Safety section of this ESIA.	See Road Safety section

7.14.7. Monitoring

Table 99 summarises the community health and safety monitoring requirements. Observational monitoring per the ESMP is the primary approach throughout. The Grievance Register is the central live monitoring tool for community concerns.

Table 99: Monitoring – Community Health and Safety

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Notes
Construction Phase					
Traffic safety in settlements	Speed limit compliance; flagger deployment; pedestrian crossing conditions; school crossing marshal presence at school start and finish times; traffic incidents involving community members	Daily during all construction phases with active works in or near settlements	All settlements along 56 km corridor; school crossing points; active haul routes through communities	Contractor (Traffic Manager / Site Supervisors); SCLO	Daily traffic management log. Any traffic incident involving a community member reported to ESHS Manager and Engineer within 1 hour regardless of apparent severity. Monthly summary in CHS report.
Construction site security	Fencing and signage of all open excavations; exclusion zone integrity at borrow pits, spoil sites, and work fronts; no unauthorised access incidents	Daily check before end of each working day	All open excavations, borrow pits, spoil sites, and work fronts adjacent to settlements	Contractor (Site Supervisors)	Daily site security log. Any public access incident reported to ESHS Manager. Monthly summary in CHS report.
Access continuity monitoring	Confirmed alternative routes in place before disruption; 48-hour advance	Weekly throughout construction; verified before any planned road closure	All active construction sections; all irrigation channels and agricultural access tracks in	SCLO	Weekly settlement interface inspection record. Consultation log with affected communities. Access complaints actioned

	notice records; irrigation channel and agricultural access continuity; restoration of any accidental damage within 24 hours	or access restriction	construction footprint		within 24 hours per Annex 2 of ESMP.
Grievance register	Number, nature, and status of all community grievances; response times against GRM targets; unresolved grievances	Grievances logged same day received; register reviewed weekly; monthly summary to Engineer	All settlements along corridor; all construction sites	SCLO; ESHS Manager	Site Grievance Register per Annex 2 of ESMP. All grievances logged including verbal complaints. SEA/SH grievances handled under separate confidential protocol. Monthly report to Engineer.
SEA/SH — Code of Conduct compliance	Code of Conduct signed by all workers; evidence of monthly SEA/SH toolbox talks delivered; any SEA/SH allegations received and their resolution status	Induction verification before any worker commences; monthly toolbox talk record; continuous monitoring of community relations	All construction camps and work fronts	SCLO; ESHS Manager	Signed CoC register. Monthly toolbox talk attendance record. Any SEA/SH allegation reported to PIURR within 24 hours under confidential protocol. Monthly compliance summary in CHS report.
Communicable disease awareness	HIV/STD awareness programme delivered within 2 weeks of mobilisation; repeat programmes at 4-monthly intervals; camp health provisions in place	Within 2 weeks of mobilisation; then every 4 months throughout construction	All construction camps	Contractor (ESHS Manager / contracted health service provider)	Training attendance records. Health provider delivery confirmation. Monthly camp health check.
Operational Phase					
Operational road safety monitoring	See Road Safety section	See Road Safety section	See Road Safety section	See Road Safety section	Operational phase road safety monitoring — traffic accidents, school zone safety, speed limit compliance — is addressed in the Road Safety section monitoring table.



7.15. Road Safety

7.15.1. Project Activities with Potential to affect road safety

Road safety impacts are relevant across both the construction and operational phases of the BSK Project. During construction, the project generates safety risks through the introduction of heavy plant and construction traffic onto an existing community road. In operation, the provision of a paved, geometrically improved carriageway creates new safety dynamics by inducing vehicle speeds well in excess of those achievable on the existing track.

The following construction activities have the potential to affect road safety:

- Operation of heavy construction vehicles, excavators, and aggregate haul trucks on and adjacent to the road corridor, which continues to serve approximately 6,000 residents throughout the construction period.
- Opening of active work fronts within and adjacent to the settlements — creating open excavations, unlit working areas, and hazardous plant movements in close proximity to community populations including children.
- Haul route operations, including heavy vehicle movements on the project road and on unpaved access tracks to borrow pits and quarries, and oversize load deliveries for bridge equipment.
- Installation of road safety infrastructure as specified in the design, including safety barriers, vehicle restraint systems, guideposts, chevron markers, road markings, pedestrian crossings, bus stop facilities, and speed restriction signage — directly determining operational safety outcomes.
- Bridge construction at all bridge locations, introducing permanent parapets, vehicle restraint systems, and carriageway cross-sections.
- Road opening and the commencement of operational traffic, introducing a paved Category V road to a corridor where current vehicle speeds are physically constrained by the condition of the existing gravel track.

7.15.2. Sensitive Receptors

Residents of the settlements along the corridor — Approximately 6,000 people live within the Project corridor and interact with portions of it daily for movement to and from home, school, agricultural land, and community services. Children, elderly people, and people with disabilities represent the most vulnerable within this population and will be present on or adjacent to the carriageway throughout the day.

Pedestrians and non-motorised road users — The dominant road user group on the existing corridor and expected to remain so on the new road. The project road passes through or adjacent to numerous settlement areas where pedestrian activity is concentrated. Tajikistan's national casualty profile shows pedestrians and cyclists accounting for approximately 42% of all road traffic fatalities — significantly above the Asia-Pacific average of 31% — underscoring the acute vulnerability of non-motorised users in this national context.

Road users and vehicle occupants — Those who will travel the corridor after opening, including local residents, freight operators, and tourists accessing the Sari Khosor area. These users face the primary risk of single-vehicle run-off-road crashes in locations where the road runs immediately adjacent to the Shurobdaryo and where falls from the carriageway edge are significant.



Livestock and herding communities — Cattle, sheep, and goats are regularly moved along and across the corridor by herding communities. Construction vehicle collisions with livestock represent both a safety and livelihood impact and require active management throughout the construction period.

Construction workers and the public at work zones — International research indicates that the risk of a serious or fatal road crash is up to five times greater in road works than on an equivalent section of open road. Work zone safety is an important and often neglected dimension of road construction in the CAREC region, including in Tajikistan.

7.15.3. Potential Impacts

Construction Phase

Road User Accidents at Work Zones — The existing road carries approximately 10–20 vehicles per day on its upper sections and slightly higher volumes near Baljuvon. Although volumes are low by international standards, the complete absence of road safety infrastructure — no signage, markings, barriers, or pedestrian facilities — means that the introduction of construction traffic represents a materially elevated risk to road users and construction workers.

The absence of alternative routes means that traffic will continue to pass through portions of active construction zones throughout the construction period. Site-specific traffic management is therefore required at every active work front from the first day of works.

Pedestrian and Community Safety at Work Fronts — Work fronts will be established at multiple locations along the corridor. In settlement areas — including Toidara, Shahidon, Mullokoni, and other villages — open excavations, plant movements, and access tracks will be in close proximity to the resident population. Children represent a particular concern, given the documented pattern of informal access to construction sites in similar project contexts. The absence of existing pedestrian infrastructure means that community members have no established separation from vehicular movement and are accustomed to sharing the road surface.

Livestock Collision and Injury on Haul Routes — Cattle, sheep, and goats are regularly moved along and across the corridor by herding communities. Construction vehicle collisions with livestock at informal crossing points represent a risk to both animals and vehicle occupants, and carry the potential for livelihood conflict and community relations impacts if not managed proactively.

Operational Phase

Vehicle Speed Increase and Run-Off-Road Crashes — This is the most significant road safety impact of the BSK Project. The new paved road will offer drivers a surface on which they will travel at speeds materially above the 40 km/h design speed. The design speed for a Category V road is a geometric design parameter — it governs minimum horizontal curve radii and sight distances — and is not a reliable predictor of operating speed on a rural road in Tajikistan. The RSIA judges, based on comparable road rehabilitation projects in the CAREC region, that operating speeds on the new road may be up to 50% higher than on the existing track. On the many straight sections of the corridor, some drivers will substantially exceed both the design speed and the posted speed limit.

The consequences of speed increase are acute given the physical setting. For the majority of its length the road runs immediately adjacent to the Shurobdaryo, with drops from the carriageway edge directly to the river channel or excavated slopes below. There are multiple locations throughout the corridor — particularly in Section 2 between km 20+100 and km 56+300 — where vehicle restraint systems are absent or have gaps adjacent to excavations and river embankments. At these locations, an errant vehicle leaving the carriageway at elevated speed would have no secondary protection before entering the river or the slope below.

Pedestrian and Vulnerable Road User Collisions in Settlements — Pedestrians are expected to remain the largest road user group on the new road. Children, elderly people, and people with disabilities will



be present on and adjacent to the carriageway throughout the day in and around settlements, particularly near schools, medical centres, and bus stops. There are multiple bus stop locations planned — at km 46+980/47+040, km 48+280/48+320, km 50+240/50+300, and km 52+480/52+540 — where pedestrians can only reach the bus stops by walking in the carriageway.

Speed restriction signage alone in settlement areas will not achieve driver compliance. According to the RSIA without physical traffic calming, such as road humps, unsafe speeding through settlements will remain after the road opens.

Bridge Safety — Vehicle Restraint Transitions and Cross-Section Design — this is a risk at all bridge locations: the current design drawings do not show how the vehicle restraint system on the approach to each bridge transitions into the bridge parapet. An inadequate connection between these elements means that a vehicle striking the restraint system at or near the bridge end could cause it to fail at the transition point, allowing the vehicle to pass through the parapet into the watercourse below. This is a design issue requiring resolution before construction of each bridge structure commences.

The RSIA raises an additional concern about the standard bridge cross-section: the proposed concrete barricades act as inherent roadside hazards, and the 1.0-metre footpaths are assessed as too narrow for comfortable pedestrian use. A strong bridge railing combined with wider shoulders is recommended as a safer and lower-cost alternative.

Minor Junction Safety — Unprotected Excavations — The RSIA identified a recurring concern throughout Section 2: at multiple bellmouth junctions connecting the project road to side roads and settlements, the vehicle restraint system is not continued through the junction. On either side of these junctions, unprotected excavated slopes exist on the west side of the carriageway. A vehicle turning into or out of a minor junction risks leaving the carriageway and entering the excavation, with the potential for vehicle rollover and injury to occupants. This is a design modification addressable at relatively low cost before the relevant construction sections commence.

Road Terminus Safety — End of Road at km 56+300 — The RSIA identified a risk issue at the northern terminus of the project road. There is no advance warning to northbound drivers that the road ends, and insufficient space for vehicles to turn at the terminus. The risk of a vehicle overshooting the end of the road, or struggling to turn and entering the adjacent excavation or striking the gabion wall, is addressable through provision of advance signing and a turning head.

Cumulative Impacts

No significant cumulative road safety impacts have been identified beyond those assessed in this section. There are no other major road or infrastructure projects proposed in proximity to the corridor that would interact materially with the road safety impacts of the BSK Project. Traffic growth of approximately 10% per annum is anticipated following road opening; this growth over time will gradually increase the exposure frequency of pedestrian and vulnerable road user risks in settlement areas, reinforcing the importance of physical speed calming in settlements as the primary long-term control.

Transboundary Impacts

All construction activities and road operations are located within Tajikistan. No transboundary road safety impacts are anticipated.



7.15.4. Impact Summary and Assessment of Significance

Table 100 provides an assessment of the significance of potential road safety impacts before implementation of the proposed mitigation measures. Impact significance is assessed based on the magnitude of the potential impact, the sensitivity of receptors, the spatial scale, timeframe, and probability of the impact occurring.

Table 100: Impacts and Significance – Road Safety

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
Construction Phase												
C	Road user accidents at work zones — introduction of heavy construction traffic onto a community road with no alternative route, no existing safety infrastructure, and continued public through-traffic throughout the construction period	Road users; construction workers; residents in 19 settlements	M	H	H	M	MOD	ST	INT	H	POSS	Medium
C	Pedestrian and community safety at work fronts — open excavations, plant	Residents adjacent to active work fronts; children; elderly	H	H	H	M	MOD	ST	INT	H	POSS	Medium

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	movements, and unlit hazards in close proximity to settlements including children, in the absence of any existing pedestrian separation from the carriageway											
C	Livestock collision and injury on haul routes — construction vehicles striking cattle, sheep, and goats at informal crossing points along the corridor, with associated livelihood and community relations consequences	Livestock; herding communities	M	M	M	L	MIN	ST	SMA	M	POSS	Low
Operational Phase												
O	Vehicle speed increase and run-off-road	Vehicle occupants; all	H	H	H	H	MAJ	LT	INT	H	DEF	

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	crashes — paving induces operating speeds materially above the 40 km/h design speed on a corridor where the carriageway edge is immediately adjacent to the Shurobdaryo with drops to the river channel or excavated slopes below	road users on 56 km corridor										
O	Pedestrian and vulnerable road user collisions in settlements — increased vehicle speeds and higher traffic volumes on the paved road, in areas where pedestrians including children and	Pedestrians, children, elderly, and people with disabilities in 19 settlements	H	H	H	H	MAJ	LT	INT	H	DEF	

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	elderly people share the carriageway and no physical separation exists											
O	Bridge safety — vehicle restraint system transition failures and cross-section hazards — absence of confirmed transition details between approach restraint systems and bridge parapets at all 10 bridge locations creates risk of errant vehicles breaching the parapet into the watercourse below	Vehicle occupants at 10 bridge crossings	M	H	M	M	MAJ	LT	SMA	H	POSS	Medium

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
O	Minor junction safety — unprotected excavated slopes at bellmouth junctions — vehicle restraint systems not continued through multiple junctions in Section 2, leaving unprotected excavations on the carriageway edge at turning movements	Drivers at junctions along Section 2	M	M	M	M	MOD	LT	SMA	H	POSS	Medium
O	Road terminus safety — absence of advance warning and turning provision at km 56+300, creating risk of vehicles overshooting the road end or striking the	Northbound drivers approaching the terminus	L	M	L	L	MOD	LT	SMA	H	POSS	Low



Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	adjacent gabion wall											

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minor / LT: Long term / MT: Medium Term / ST: Short term / SMA: Small / INT: Intermediate / EXT: Extensive / DEF: Definitely / POSS: Possible / UNLIKE: Unlikely. Phase: C = Construction; O = Operation.



7.15.5. Mitigation and Management Measures

Design Phase

Road Safety Infrastructure Specification — A number of road safety measures are embedded in the detailed design and form the minimum specification for the Contractor. The design specifies safety barrier locations and performance classes, guide post spacing, chevron marker locations, road markings, speed restriction signage, humped pedestrian crossings in village areas, and community protection measures at sensitive receptors. The Contractor must install all road safety infrastructure as specified and must not omit or modify any element without the Engineer's written approval.

Vehicle Restraint System Extensions at Minor Junctions — The design team shall identify all affected junctions, incorporate the necessary extensions into the construction drawings, and confirm resolution before the relevant sections commence construction.

Road Terminus Provision at km 56+300 — Advance signing and a turning head are not currently included in the design. These shall be incorporated into the drawings before the terminal section commences construction.

Bridge Parapet Transition Details — The design team shall produce drawings showing the specific transition connection at each location, and the Engineer shall not certify the design as complete for any bridge until this has been addressed.

Speed Management in Settlements — Speed restriction signage of 40 km/h in all village areas and 60 km/h in rural sections is to be installed in accordance with GOST standards. The RSIA and RSA are explicit that signage alone is insufficient to achieve driver compliance in settlement areas; physical calming is the primary speed control measure and the more important of the two interventions.

Pedestrian Footways at Bus Stop Locations — Pedestrian footways connecting these stops to the surrounding road network are not currently included in the design. This requires resolution before construction drawings for the affected sections are finalised and issued for construction.

Construction Phase

Work Zone Traffic Safety - The Contractor shall prepare a site-specific Traffic Management Plan (TMP) for each work zone in accordance with the CAREC Road Safety Engineering Manual 2 — Safer Road Works (2018), as part of CESMP-03. Each TMP shall be approved by the local traffic authorities and the Engineer before the relevant work zone opens. The absence of alternative routes means there is no option to divert traffic around the works; all arrangements must therefore manage through-traffic safely throughout the construction period.

Each TMP shall implement as a minimum: advance warning signs and taper signs on the approach to the work zone; a 40 km/h speed restriction through the works, reduced further if required by site conditions; barrier delineation and retroreflective delineation for night-time work zones; and trained flaggers at all single-lane controlled sections. No work zone shall operate at night without retroreflective delineation in place. All authorities shall be notified of oversize loads and police escorts arranged before transport. Construction traffic warning signs shall be installed at all road crossings and along access routes. A baseline condition survey of all access roads and the project road shall be completed and photographically recorded before construction commences, establishing the pre-construction condition against which any damage attributable to the works can be assessed.

Community Safety and Livestock - Community safety at work fronts and livestock management are managed together as they share a common geography — the settlement areas and informal grazing routes along the corridor — and require continuous coordination with local communities through the Social and Community Liaison Officer (SCLO).

Community Safety at Work Fronts — All active work fronts adjacent to settlements shall be fenced and signposted at all times, including overnight and during weekends, with night lighting required at



work fronts near settlements with elevated community access risk. Safe pedestrian detour routes shall be maintained around all road closures and inspected daily. Community GRM contacts shall be publicised in all affected villages. Community road safety awareness sessions shall be delivered to all local schools at the start of works in each village, with attendance records maintained. All hazardous conditions shall be either actively attended or fully protected overnight; no open excavation adjacent to a settlement shall be left unfenced at any time.

Livestock Safety — All informal livestock crossing points along the alignment shall be identified before works commence. Temporary flaggers, barriers, and warning signs shall be installed at all active crossings, and crossing times agreed with communities and herders where practicable. All open excavations, borrow areas, and dewatered areas shall be fenced against livestock entry and inspected daily. Herding communities shall receive not less than 72 hours advance notice of planned closures. Any livestock injury or death shall be recorded and compensated promptly through the GRM.

Vehicle Speed Management on Haul Routes - Haul route speed management is a primary mechanism for reducing the risk of community and livestock collisions during construction, and applies to all construction vehicles throughout the contract. The Contractor shall enforce the following speed hierarchy: not more than 40 km/h on the project road; not more than 30 km/h on unpaved haul routes; not more than 20 km/h through settlements; and not more than 10 km/h within construction sites. Weekly speed spot checks shall be conducted and recorded. Night-time driving by construction vehicles is prohibited except with prior written Engineer approval, with all night movements logged. Heavy haul traffic through settlements is prohibited during school start and end hours unless unavoidable and pre-approved by the Engineer.

Operational Phase

Pre-Completion Road Safety Audit — The Engineer shall commission an independent Stage 3 Road Safety Audit of the completed works prior to practical completion and before the road is opened to public traffic. The audit shall verify that all Stage 2 RSA recommendations have been implemented, that all road safety infrastructure is correctly installed, and that no new safety concerns have been introduced during construction. The Contractor shall incorporate any additional measures identified before practical completion is certified. The audit report shall be submitted to PIURR and EBRD.

Community Road Safety Awareness Programme — A community road safety awareness programme shall be implemented in all settlements in the period immediately before and after road opening, addressing the new road conditions — increased speeds, paved surfaces, higher traffic volumes — and providing practical guidance to residents, particularly children and young people. The programme shall draw on lessons from comparable initiatives on the Obigarm–Nurabod Road, as recommended in the RSIA, and shall be delivered by PIURR in coordination with local schools and Jamoats.

Police Speed Enforcement — PIURR shall engage with the Ministry of Interior and the relevant traffic police authorities to establish periodic speed enforcement on the project road during the initial operational period, with particular focus on settlement areas in the months immediately following road opening, when the adjustment of driver behaviour to the new road conditions is most acute.

Road Safety Management Plan — PIURR shall prepare a Road Safety Management Plan (RSMP) for the operational phase, covering speed monitoring protocols, road incident reporting and investigation procedures, maintenance schedules for road safety infrastructure (guardrails, markings, signs, delineation), arrangements for periodic road safety reviews, and the mechanism for escalating to additional physical interventions if before-and-after speed studies indicate that operating speeds materially exceed targets.

7.15.6. Residual Impacts

Table 101 provides an assessment of residual road safety impacts following implementation of the mitigation measures described above. The RSIA acknowledges that road trauma is likely to increase

marginally with the new road compared to the present situation — specifically, that single-vehicle run-off-road crashes and collisions between motor vehicles and vulnerable road users will increase due to higher operating speeds and increased traffic volumes. The mitigation hierarchy is designed to keep this increase as low as practicable and to reduce its severity through infrastructure that prevents errant vehicle falls to the river, physical calming that manages speeds in the locations of highest pedestrian risk, and monitoring that provides an early warning mechanism if additional interventions are required

Table 101: Residual Impacts – Road Safety

ase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
C	Road user accidents at work zones	Medium	Residual risk reflects the inherent unpredictability of driver behaviour on a road carrying live traffic throughout construction.	Low
C	Pedestrian and community safety at work fronts	Medium	Residual risk is associated with informal access and requires sustained vigilance throughout the construction period.	Low
C	Livestock collision and injury	Low	Residual livestock strike risk is low with crossing point identification, temporary barriers, and advance notification to herding communities.	Low
O	Vehicle speed increase and run-off-road crashes	High	Some increase in run-off-road crashes is expected under the with-project scenario. Layered infrastructure mitigation keeps the increase as low as practicable and reduces severity. Residual risk reflects the documented response of driver behaviour to improved road surfaces.	Low – Medium
O	Pedestrian and vulnerable road user collisions in settlements	High	Physical calming measures are essential — signage alone is insufficient to achieve speed compliance. Residual risk reflects continued pedestrian exposure where footway provision does not extend to every corridor section.	Low – Medium
O	Bridge safety — restraint system transitions and cross-section hazards	Medium	Residual significance is Not Significant if transition details are resolved and RSA cross-section recommendations incorporated; remains Low–Medium if current cross-sections proceed unmodified.	Not Significant
O	Minor junction safety — vehicle restraint system gaps	Medium	No material residual risk with VRS extension into all bellmouth junctions incorporated before construction of affected sections.	Not Significant

ase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
O	Road terminus safety — km 56+300	Low	No material residual risk with advance signing and turning head incorporated into the design before the terminal section commences construction.	Not significant

7.15.7. Monitoring

Table 102 summarises the road safety monitoring requirements for the Project. The before-and-after operating speed study is the critical adaptive management tool for the operational phase: if 85th-percentile speeds at settlement locations significantly exceed the posted limit in the period following road opening, the Engineer shall recommend additional physical calming measures to PIURR for implementation.

Table 102: Monitoring – Road Safety

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Equipment
Construction Phase					
Traffic Management Plan compliance	Daily TMP compliance; flagging records; traffic incidents and near-misses; oversize load notifications; speed spot checks against vehicle speed hierarchy (≤40 km/h project road; ≤30 km/h haul routes; ≤20 km/h settlements; ≤10 km/h on site)	Daily per active work zone; weekly speed spot checks	All active work zones on 56 km corridor	Contractor (ESHS Manager); reviewed by Engineer	TMP compliance log. Traffic incident and near-miss register. Speed check records. Monthly report to Engineer. CESMP-03 reference.
Work front safety inspection	Fencing and night lighting of open excavations; safe pedestrian detour routes; community safety awareness session delivery; GRM safety complaints	Daily at settlement work fronts	All work fronts adjacent to the 19 settlements	Contractor (ESHS Manager); Engineer verification	Work front barrier and signage photographs (daily). Night lighting records. Pedestrian route inspection log. School session attendance records. Zero public injuries target.
Construction vehicle speed checks	Vehicle speeds against speed hierarchy at key points along the project road, haul routes, and settlement crossings	Weekly spot checks; triggered by any incident or complaint	Project road, unpaved haul routes, and settlement crossings	Contractor (ESHS Manager); Engineer audits	Portable speed measurement device. Speed spot check records. Night driving approval logs. Access closure notification records (≥72 hrs advance notice).
Operational Phase					
Before-and-after	85th-percentile vehicle operating	Baseline before road	Minimum 3 settlement	PIURR / Road Operator with	Radar gun or pneumatic tube counter. If 85th-

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Equipment
operating speed study	speeds at representative settlement and rural sections; comparison to 40 km/h design speed and posted speed limits	opening; 6 months; 12 months, and 36 months post-opening	locations (Toidara, Shahidon, Mullokoni) and 2 open rural sections	specialist road safety input	percentile speed exceeds 60 km/h in rural sections or 50 km/h in settlements, Engineer to recommend additional physical calming measures. Results reported to EBRD in semi-annual EMR.
Road incident and casualty monitoring	Reported road traffic incidents, injuries, and fatalities on the project road, categorised by location, user type, and incident type	Annually; immediate review triggered by any fatality or serious injury	Full 56 km project corridor	PIURR / Road Operator; coordination with Traffic Police	Incident register maintained by Road Operator. Annual summary to PIURR. Any fatality triggers independent investigation and corrective action review. Reported to EBRD in semi-annual EMR.
Pre-completion road safety audit	Compliance with all Stage 2 RSA recommendations; road safety feature installation; bridge restraint system transitions; pedestrian facilities at bus stops; road terminus provision at km 56+300	Once, prior to practical completion and before public opening	Full project corridor including all 10 bridge locations and settlement areas	Engineer (commissions independent auditor); PIURR oversight	Independent Stage 3 Road Safety Audit by qualified auditor. All RSA recommendations resolved or formally accepted with justification before practical completion is certified. Audit report submitted to EBRD.
Community road safety awareness monitoring	Evidence of awareness programme delivery in schools and communities along the corridor; road safety complaints in the GRM	Annual review	All 9 settlements along the 56 km corridor	PIURR / Road Operator; Community Liaison Officer	Records of awareness sessions delivered. GRM road safety complaints log. Recurrent complaint patterns trigger review of physical calming interventions.

7.16. Labour and Working Conditions

The BSK Project will mobilise a substantial construction workforce to rehabilitate 56 km of road in a remote mountain valley with no established construction industry presence. The workforce will include skilled and semi-skilled workers drawn from outside the corridor alongside unskilled labour recruited locally, operating across multiple work fronts simultaneously, in extreme seasonal conditions, and at significant distance from district health and emergency services. This section addresses the rights and protections owed to workers under Tajik law and EBRD ESR2 — employment terms, working hours, wages, child and forced labour, worker grievance, local recruitment, accommodation as a contractual condition, and the social-influx dimension of labour management. Occupational health and safety risks arising from construction work are addressed in the separate Occupational Health and Safety section that follows; both topics fall under EBRD ESR2.

7.16.1. Project Activities Affecting Labour and Working Conditions

The following construction activities are the primary sources of labour and working conditions risks:

- Mobilisation and deployment of a contractor workforce across the 56 km corridor, involving recruitment of workers from within and outside Tajikistan, establishment of construction



camps providing accommodation, food, water, and sanitation, and management of subcontractor labour chains with differing employment practices.

- Local recruitment of unskilled labour from corridor settlements over a multi-year construction programme, with implications for community livelihoods, gender-equitable opportunity, and skills development.
- Worker-community interaction arising from the introduction of a non-local, predominantly male workforce into small, close-knit rural settlements along the corridor — the primary pathway for labour influx social impacts including SEA/SH risk and communicable disease transmission.
- Worker accommodation in construction camps over the multi-year contract period, with HR-regime implications including freedom of association, worker grievance access, and protection from retaliation.

7.16.2. Sensitive Receptors

Direct construction workers — The primary receptors for employment, wage, hours, and contractual rights. Workers from outside Tajikistan may face additional vulnerability arising from unfamiliarity with local conditions, language barriers, and distance from social support networks.

Subcontractor workers — Workers employed by subcontractors rather than the main Contractor face elevated risk of rights violations, including wage abuse, recruitment fees, document retention, and exclusion from the worker grievance mechanism. The remote setting and multi-tier contracting structure amplify this risk.

Local communities along the corridor — Receptors for the positive impact of local employment opportunity and the negative impact of labour influx tensions, including unemployed and underemployed adults, FHHs, and households on the Vulnerability Register.

Women and girls in corridor communities; female workers — Receptors for SEA/SH risk arising from non-local male workforce presence; receptors for the positive impact of equitable access to employment opportunity if recruitment is gender-balanced.

7.16.3. Potential Impacts

Construction Phase

Worker Rights and Employment Conditions — The Tajikistan Labour Code (2016) establishes the principal national framework for employment rights, covering minimum working age, working hours, prohibition of forced labour, and occupational health and safety. The Code sets a minimum employment age of 15, with restrictions on the type and hours of work permissible for those under 18. In practice, enforcement by the State Labour Inspectorate is constrained in remote construction settings, and the distance of the BSK corridor from district centres reduces the likelihood of routine inspection. This gap between legal requirement and enforcement reality elevates the risk that wage violations, excessive hours, unlawful deductions, and inadequate contracts go undetected, particularly in subcontractor operations where oversight is more limited.

Forced labour risks in the conventional sense are not assessed as high on this project given the domestic legal framework and the employer-employee structure. However, practices that approach forced labour conditions — including excessive working hours without consent, document retention, or recruitment fees that create debt bondage — represent a real risk in remote construction settings in Central Asia and require active prevention through the Labour Management Plan.

Child Labour — The Labour Code sets a minimum employment age of 15, below the ILO standard of 16 and the EBRD ESR2 requirement of 18 for hazardous work. All construction work on the BSK Project qualifies as hazardous. The risk of underage workers being engaged, particularly through



subcontractor supply chains where recruitment oversight is weaker, requires mandatory age verification at the point of recruitment and across all subcontractor workforces. This is a standard construction labour risk that is manageable through controls but requires active monitoring rather than passive reliance on legal compliance.

Local Employment Opportunity (positive) — Construction is expected to generate a substantial number of unskilled and semi-skilled positions accessible to corridor residents. This is a significant potential positive impact for local livelihoods, particularly given the limited alternative wage employment in Baljuvon district. The benefit will only be realised, however, if recruitment is transparent, accessible, and gender-equitable. Two specific risks exist: (i) capture of recruitment by external labour agents who supply the workforce from outside the corridor, displacing the local opportunity; and (ii) gendered hiring patterns that systematically exclude women and FHHs from the available roles. The Local Recruitment Targets and the Worker Grievance Mechanism described under Mitigation are the primary controls.

Unskilled Workforce — Engagement of unskilled local labour brings the positive impact above but also introduces specific risk: workers without prior construction experience may be more vulnerable to OHS incidents (addressed in the OHS section), may have lower familiarity with their employment rights, and may be at greater risk of subcontractor wage abuse where their bargaining position is weaker. Mandatory induction in workers' own language, the Worker Grievance Mechanism, and the independent annual labour audit are designed to compensate for this vulnerability.

Worker Grievance Mechanism — An effective Worker Grievance Mechanism (Worker GRM) is a primary EBRD ESR2 requirement and is distinct from the community GRM. The risks it is designed to address include subcontractor wage and contract violations, retaliation against workers raising concerns, exclusion of female workers from grievance access, and SEA/SH reporting from within the workforce. The Worker GRM must be confidential, accessible at every camp and work front, available in Tajik and Russian, and operate without retaliation against users. Workers must be reminded of the mechanism at induction and at monthly safety meetings throughout the contract.

Labour Influx, SEA/SH, and Communicable Disease — Communicable disease transmission between the workforce and local communities — including HIV and sexually transmitted infections, tuberculosis, and locally endemic conditions — represents a standard labour influx health risk that is manageable through mandatory awareness programmes but requires sustained delivery rather than a single induction session. SEA/SH risk arising from non-local male workforce presence in close-knit rural communities is the most consequential community-facing labour influx risk and requires the prevention and response framework described under Mitigation.

Cumulative Impacts

No significant cumulative labour and working conditions impacts beyond those assessed in this section have been identified. There are no other major construction projects in the BSK corridor that would interact with the workforce of the BSK Project. The cumulative effect of sustained worker presence over a multi-year construction period on community attitudes toward external workers is a longer-term social dynamic that reinforces the importance of local recruitment, worker self-sufficiency in camps, and active community liaison throughout the contract.

Transboundary Impacts

All construction activities are located within Tajikistan. No transboundary labour and working conditions impacts are anticipated.

7.16.4. Impact Summary and Assessment of Significance

Table 103: Impacts and Significance — Labour and Working Conditions

Phase	Potential Impact	Receptors	No.	Sens	Concern	Legal	Mag	Time	Spatial	Cons	Prob	Sig
C	Wage violations, excessive working hours, unlawful deductions, and non-provision of written contracts — risk elevated by remote location and limited oversight by national labour inspectorate	Construction workers; subcontractor workers	H	M	M	H	MAJ	ST	SMA	H	POSS	Medium
C	Child labour or forced labour — underage workers in subcontractor chains; debt-bondage / document retention practices	Workers; children	M	H	H	H	MAJ	ST	SMA	H	POSS	Medium
C	Labour influx tensions — social conflict, pressure on community services, and worker-community frictions arising from non-local workforce	Host communities in corridor settlements; workers	H	M	M	M	MOD	ST	INT	M	POSS	Medium
C	SEA/SH — risk of sexual exploitation, abuse, and harassment by workers affecting community members and female workers	Women and girls in corridor communities; female workers	M	H	H	H	MAJ	ST	SMA	H	POSS	Medium
C	Communicable disease — transmission of HIV/STI, TB, and other diseases between workforce and local communities	Communities along corridor; workers	M	M	M	M	MOD	ST	INT	M	POSS	Low
C	Local employment opportunity (+) — corridor residents gain access to construction wages and skills development; risk of failure to deliver if recruitment is captured by external labour agents or by male hiring patterns that exclude women and FHHs	Corridor communities, particularly unemployed and underemployed adults; FHH; vulnerable households	H	M	H	M	MOD	ST	INT	M	POSS	Medium (+)

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minor / LT: Long term / MT: Medium Term / ST: Short term / SMA: Small / INT: Intermediate / EXT: Extensive / DEF: Definitely / POSS: Possible / UNLIKE: Unlikely. Phase: C = Construction; O = Operation. (+) denotes positive impact.



7.16.5. Mitigation and Monitoring Measures

Pre-Construction Phase

Labour Management Plan — The Contractor shall prepare and implement a Labour Management Plan (LMP) in accordance with the Framework in Annex 9 of the ESMP and consistent with EBRD ESR2. The LMP shall be site-specific and shall address: employment terms and contracts, working hours, wages and deductions, prohibition of child and forced labour, age verification procedures, worker grievance mechanism, local recruitment targets and procedures, camp standards (HR dimension), freedom of association, and SEA/SH prevention and response. The LMP shall be submitted to the PIURR for approval before mobilisation commences. No workers shall be engaged before the LMP is approved.

Local Recruitment Targets — The Contractor shall agree local recruitment targets with PIURR before mobilisation, including a target for women and a target for FHHs reflecting the corridor's social composition. Unskilled labour shall be preferentially recruited from project-affected communities along the corridor. All vacancies shall be advertised locally using media accessible to corridor communities, including women-accessible channels. Recruitment procedures shall be transparent, public, and non-discriminatory; no discrimination on grounds of gender, ethnicity, age, or disability is permitted. A ballot system shall be applied for fair selection where demand for positions exceeds available posts. Local procurement of goods and services within Tajikistan shall similarly be maximised.

SEA/SH Plan Preparation — A SEA/SH Prevention and Response Plan consistent with EBRD ESR2, ESR4, and ESR10 shall be prepared as part of CESMP before mobilisation. The Plan shall set out: Code of Conduct commitments and signing requirements, SEA/SH awareness training schedule, confidential reporting channel arrangements accessible to both workers and community members, survivor-centred response protocols, referral pathways for survivors, SEA/SH focal point designation, and quarterly reporting to PIURR.

Construction Phase

Employment Contracts and Wages — Written employment contracts in workers' own language shall be provided to all workers before they commence work — signing a contract is a condition of starting on site, not a subsequent administrative step. Wages shall be paid in full and on time with no unauthorised deductions. Wages shall be paid by bank transfer or through a verifiable electronic payment system. Cash payment is only permitted where a worker has no access to a bank account, in which case payment shall be made in the presence of a witness, evidenced by a signed and dated receipt countersigned by the worker and recorded in the payroll register. The Engineer shall be notified of any worker being paid in cash and the reason for this, in accordance with ESMP measure C-LB-01. The maximum working week is 48 hours; overtime is voluntary and paid at a premium rate. No recruitment or placement fees shall be charged to workers at any stage. No identity or travel documents shall be retained by the Contractor or any subcontractor under any circumstances. These requirements apply to all workers including those engaged through subcontractors; the Contractor retains ultimate responsibility for compliance throughout the supply chain.

Child Labour Prevention — No person under 18 years of age shall be employed on any aspect of the Project, including by subcontractors. All workers shall be subject to age verification at recruitment, with documentary evidence retained on file and available to the Engineer on request. The worker register, which is accessible to the Engineer at all times, shall record the age of every worker. Subcontractor worker registers are subject to the same access requirement.

Worker Grievance Mechanism — A Worker GRM operating separately from the community GRM shall be established and communicated to all workers at induction in Tajik and Russian. The mechanism shall include: a confidential channel for reporting concerns including SEA/SH, a designated worker GRM focal point, defined response timelines, protection from retaliation, and escalation pathways to PIURR and EBRD. A clearly displayed Worker GRM poster (with the focal point name, contact, and



reporting channels) shall be placed in every camp and at every work front. Workers shall be reminded of the mechanism at monthly safety meetings throughout the contract, with attendance recorded.

Local Recruitment and Procurement Implementation — The Contractor shall report local hiring proportion, gender breakdown, and FHH inclusion monthly. Where targets are not met, the Contractor shall present remedial recruitment actions to the Engineer. Subcontractor recruitment is subject to the same targets and reporting. Local procurement records shall be maintained and reported quarterly.

Worker Self-Sufficiency and Camp Separation — Construction camps shall provide all food, water, sanitation, and services for the workforce, maintaining worker self-sufficiency and minimising the demand the workforce places on community infrastructure. Workers shall not be permitted to establish informal accommodation in community residential areas. Recreational facilities within camps shall be provided to reduce off-site social pressures. The Community Health and Safety Plan (Annex 2 of the ESMP) governs the management of labour influx community effects and should be read alongside this section. (The occupational dimension of camp standards — sanitation, fire safety, ventilation, mental health — is addressed in the Occupational Health and Safety section.)

SEA/SH Prevention and Response — All Contractor and subcontractor personnel shall sign the Project Code of Conduct (Annex 12 of the ESMP) before commencing work; signing is a condition of employment and shall not be deferred. The Code shall be explained at induction in Tajik and Russian rather than simply distributed. SEA/SH prohibitions and confidential reporting channels shall be reinforced at monthly toolbox talks. SEA/SH reporting channels shall be communicated to communities by the SCLO at the start of works in each area, with specific communication that these channels are accessible to community members and not only workers. All SEA/SH cases shall be handled under survivor-centred protocols — confidentiality, safety, non-discrimination, and respect for survivor choices are paramount. Allegations shall be reported to PIURR within 24 hours under the agreed confidentiality protocol and investigated through the formal GRM process. Zero-tolerance disciplinary consequences, including dismissal, apply to substantiated violations.

Communicable Disease Programme — A mandatory HIV/STI awareness programme shall be delivered to all workers within two weeks of mobilisation and repeated at bi-monthly intervals (not exceeding two months) throughout construction. Camp health provisions and hygiene standards shall be maintained throughout, and health screening requirements set out in CESMP-09 shall be implemented. Community outreach on communicable disease prevention shall be delivered by the SCLO as part of the community liaison programme.

Third-Party Labour Audit — In addition to the Contractor's internal monitoring, an independent annual labour audit shall be conducted by qualified third-party auditors throughout the construction period. The audit shall assess compliance with the LMP, the Project Labour Management Plan, and EBRD ESR2. Audit findings and corrective actions shall be submitted to the Engineer and PIURR, in accordance with ESMP Annex 9, Section 11.

7.16.6. Residual Impacts

Table 104: Residual Impacts — Labour and Working Conditions

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
C	Wage violations, unlawful deductions, excessive hours, and contract failures	Medium	No material residual risk with written contracts, monthly payroll verification, and Engineer access to the worker register maintained throughout the subcontractor chain.	Not Significant

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
C	Child labour or forced labour	Medium	No material residual risk with mandatory pre-employment age verification, prohibition on identity-document retention, prohibition on recruitment fees, and Engineer access to the worker register throughout the subcontractor chain.	Not Significant
C	Labour influx tensions	Medium	Residual risk reflects the inherent social dynamics of a non-local workforce in close-knit rural communities over a multi-year construction period; managed through local recruitment, camp self-sufficiency, and SCLO outreach.	Low
C	SEA/SH	Medium	Residual risk reflects the inherent difficulty of eliminating SEA/SH risk in a labour influx context. The framework ensures rapid identification, response, and accountability for any incidents.	Low
C	Communicable disease	Low	No material residual transmission risk given the low baseline prevalence and mandatory bi-monthly awareness programme.	Not Significant
C	Local employment opportunity (+)	Medium (+)	Positive impact preserved by local recruitment targets, transparent and non-discriminatory advertising, ballot selection where demand exceeds supply, and gender-disaggregated recruitment monitoring. Risk of capture by external agents or gendered hiring patterns reduced through PIURR oversight and SCLO outreach.	Medium (+)

Note: For positive impacts (marked “+”), the residual significance is shown equal to the pre-mitigation rating, reflecting standard ESIA practice. The mitigation hierarchy (avoid – minimise – restore – offset) applies to negative impacts; for positive impacts, the project’s commitments preserve rather than diminish the benefit, so the residual rating is the assessed magnitude of the positive effect rather than a reduced version of it.

Monitoring

Table 105: Monitoring — Labour and Working Conditions

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Indicator
Labour rights compliance	Written contracts for 100% of workers; payroll records; working hours register; age verification records; recruitment fee prohibition compliance; no identity-document retention	Monthly sample review by Engineer; continuous self-monitoring by Contractor	All work fronts, camps, and subcontractor operations across 56 km corridor	Contractor (ESHS Manager); Engineer sample audits; PIURR oversight	Worker register on site, accessible to Engineer at all times. Monthly payroll and hours records to Engineer. Age verification on file. Contract clause verification at monthly ESHS meetings.
Local recruitment and procurement	Local hiring proportion of total workforce, gender-disaggregated; recruitment advertisement records; ballot system records where demand exceeds supply; local	Monthly reporting	All contractor and subcontractor workforce; procurement records	Contractor (ESHS Manager); SCLO; PIURR review	Monthly local hiring report against agreed targets, disaggregated by gender. Recruitment advertisements on file. No discrimination complaints in GRM.

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Indicator
	procurement proportion				Local procurement records.
Worker grievance mechanism	Worker GRM operational and accessible at all camps and work fronts; complaint log with response timelines; quarterly review; protection from retaliation	Continuous availability; monthly internal review; quarterly Engineer review	All camps and work fronts	Contractor (ESHS Manager); designated Worker GRM Focal Point; PIURR oversight	Worker GRM register (confidential where appropriate). Response timeline records. Worker familiarity confirmed at induction and monthly safety meetings. Quarterly Engineer review report.
SEA/SH prevention and response	Code of Conduct signed by 100% of workers; SEA/SH training attendance at induction and quarterly refreshers; confidential reporting channel operational; incident log; survivor-centred response timelines	Induction (100%); quarterly training refreshers; continuous availability; monthly log review	All camps and work fronts; community reporting channels in all settlements	Contractor (ESHS Manager); SEA/SH focal point; SCLO (community); PIURR oversight	Code of Conduct signing records. Training attendance records. Incident log under survivor-centred protocol. Response timelines. Quarterly PIURR report. Community awareness via SCLO.
Communicable disease programme	HIV/STI awareness programme delivery records; attendance at induction and bi-monthly refreshers; camp hygiene inspection records	Induction; bi-monthly refreshers; monthly camp hygiene inspection	All construction camps and work fronts	Contractor (ESHS Manager); SCLO (community outreach)	Training materials and attendance records. Camp hygiene inspection log. Community information distribution records via SCLO. Zero outbreak target.
Independent labour audit	Compliance with LMP, EBRD ESR2, and project-level labour requirements throughout the contract supply chain; closure of corrective actions	Annual independent audit	Workforce-wide; subcontractor chain	Independent third-party auditor; Engineer; PIURR	Audit reports submitted to Engineer and PIURR with corrective action plan and closure tracking, in accordance with ESMP Annex 9 Section 11.

7.17. Occupational Health and Safety

This section addresses the occupational health and safety risks faced by workers engaged on the BSK Project, both during construction and during the operations and maintenance phase that follows handover. OHS falls within EBRD ESR2 alongside Labour and Working Conditions but is treated here as a distinct sub-section because its risk profile, mitigation framework, and monitoring requirements are technically distinct from the HR-regime issues covered in the preceding section.

7.17.1. Project Activities Generating OHS Risks

- Road construction, earthworks, bridge construction, and riverbank protection works — sustained heavy physical work in mountainous terrain, operation of plant and explosives, in-



stream works at bridge and culvert locations, working at height, and operations in confined spaces.

- Slope stabilisation and rock cut works — working at height on cut slopes, exposure to rockfall hazard, blasting operations, and operation of plant on gradients.
- Demolition of legacy Soviet-era culverts and structures along the corridor — potential exposure to asbestos-containing materials (ACM) requiring pre-demolition survey, licensed-contractor removal under containment, and air clearance before reoccupation.
- Operations during summer and winter seasons — the corridor experiences temperatures exceeding 40°C in summer and dropping well below 0°C in winter, with unreliable mobile coverage across most of the upper corridor. Seasonal extreme temperature exposure and remoteness from emergency response capacity are specific risk factors on this project.
- Worker accommodation in construction camps over the multi-year contract period — occupational dimensions including sanitation, fire safety, ventilation, and the mental-health risks of family separation, fatigue, and isolation in a remote setting.
- Operations and maintenance of the rehabilitated road — routine and emergency maintenance, snow clearance, bridge inspection in flowing river conditions, slope and rockfall response, and lone working in remote sections of the alignment.

7.17.2. Sensitive Receptors

Direct construction workers — The primary sensitive receptors. Workers are exposed to the full range of construction hazards — plant, blasting, working at height, in-stream works, and extreme temperatures — across a dispersed 56 km corridor in terrain that limits rapid emergency response. Workers from outside Tajikistan may face additional vulnerability arising from unfamiliarity with local conditions, language barriers, and isolation.

Subcontractor workers — Workers employed by subcontractors face elevated OHS risk where subcontractor safety practices, PPE provision, training, and supervision are not fully aligned with the main Contractor's OHS management system. The remote setting and multi-tier contracting structure amplify this risk.

Demolition and earthworks crews — Specific receptors for asbestos exposure risk during the demolition of legacy Soviet-era structures, requiring trained and licensed handlers under containment.

Drivers and plant operators — Specific receptors for fatigue-related injury risk on long mountain shifts on steep narrow roads, with collision risk to other workers and road users.

Road operator maintenance staff (operational phase) — Receptors for OHS risks during operations: snow clearance, bridge inspection, slope and rockfall response, and lone working in remote sections.

7.17.3. Potential Impacts

Construction Phase

Occupational Injury and Fatality — The principal OHS risk categories on this corridor are:

- Bridge construction and in-stream works at all bridge sites and numerous culvert locations involve working near and in flowing water, cofferdam installation and dewatering, working at height on formwork and scaffolding, and the installation of reinforced concrete structures. Drowning, plant overturning in riverbeds, and falls from height are the specific hazard categories. A dedicated River Protection Supervisor is required during all in-stream work phases.



- Blasting operations for rock cut sections introduce the risk of flyrock, premature detonation, misfires, and blast-induced air overpressure. Only certified shotfirers may undertake blasting operations, and blast exclusion zones must be enforced without exception.
- Plant and vehicle operations on steep, narrow mountain roads throughout the 56 km corridor generate risk from vehicle overturning, collision, and runaway plant on gradients. The fatigue risk for drivers and operators on long mountain shifts is specifically elevated on this corridor and is treated as a distinct impact below.
- Working at height on bridge structures, retaining walls, and cut slopes presents fall risk throughout the construction period. A 100% tie-off requirement applies above the project-defined height threshold.
- Slope instability and rockfall are documented hazards along the corridor and present risk to workers operating beneath active cut slopes or on slope stabilisation works. Pre-shift inspection, exclusion zones, and progressive slope protection are required.

Extreme Temperature Exposure — The corridor experiences projected peak summer temperatures exceeding 40°C at the 100-year return period, a specific risk factor identified in the project Climate Risk Assessment. Outdoor workers engaged in heavy physical labour during these periods face a material risk of heat stress illness and, at the extreme, heat stroke. The risk is particularly acute in the confined valley bottom sections where air circulation is limited. In winter, temperatures drop well below 0°C. Construction activities scheduled during winter months — which may include sections of earthworks, bridge works, and riverbank protection — expose workers to cold injury and hypothermia risk. The unreliable mobile coverage across most of the upper corridor means that a worker incapacitated by cold injury on an isolated work front may not be able to summon assistance, making the buddy system and regular check-in requirements essential rather than optional.

Driver and Operator Fatigue — Long shifts on steep narrow mountain roads over a multi-year construction period generate fatigue-related risk including vehicle overturning, collision with other plant or workers, and runaway plant on gradients. This is one of two residual High-significance impacts on the project (the other being occupational injury and fatality more broadly), reflecting the inherent challenge of the corridor's terrain rather than any deficiency in mitigation.

Worker Accommodation Conditions and Mental Health — Construction camps house the workforce over the multi-year contract period in a remote setting, often distant from workers' home communities. Sub-standard sanitation, ventilation, fire safety, or potable water provision presents physical health risk; isolation, fatigue, and family separation present mental health risk. The OHS framework treats both dimensions as occupational risks distinct from the HR / accommodation as a contractual condition addressed in the LWC section. Mental health awareness in induction and toolbox talks, family contact arrangements, and access to the worker GRM and confidential reporting channel are required controls.

Asbestos Exposure — Demolition of legacy Soviet-era culverts and structures along the corridor may involve materials containing asbestos. Worker exposure during uncontrolled demolition presents long-latency health risk (asbestosis, mesothelioma). Pre-demolition ACM survey of all legacy structures, licensed-contractor removal under containment, controlled disposal to a licensed facility, and air clearance monitoring before reoccupation are required.

Operations Phase

Operations and Maintenance OHS Risks — The OHS risk profile of the rehabilitated road during operations is significantly lower than during construction but is not zero. Routine and emergency maintenance, snow clearance, bridge inspection in flowing river conditions, slope and rockfall response, and lone working in remote sections all present occupational risk. The road operator's OHS



management system shall address these specifically, including lone-working procedures, seasonal risk assessments, and emergency response arrangements developed pre-handover.

Cumulative Impacts

No significant cumulative OHS impacts have been identified. There are no other major construction projects in the BSK corridor whose workforce safety risks would interact with those of the BSK Project.

Transboundary Impacts

All construction activities are located within Tajikistan. No transboundary OHS impacts are anticipated.

7.17.4. Impact Summary and Assessment of Significance

Table 106: Impacts and Significance — OHS

Phase	Potential Impact	Receptors	No.	Sens	Concern	Legal	Mag	Time	Spatial	Cons	Prob	Sig
C	Occupational injury and fatality — risk from blasting, bridge construction, in-stream works, working at height, plant operations, and rockfall across 56 km remote mountain corridor	Construction workers; subcontractor workers	H	H	H	H	MAJ	ST	SMA	H	DEF	High
C	Heat stress illness — outdoor workers exposed to projected summer temperatures exceeding 40–50°C	Outdoor construction workers across 56 km corridor	H	H	M	H	MOD	ST	SMA	H	DEF	Medium
C	Cold exposure and remote-working risks — cold injury, hypothermia, and delayed emergency response in mountain terrain during winter operations with unreliable mobile coverage	Workers on winter work fronts; isolated work teams	M	H	M	M	MOD	ST	SMA	M	POSS	Medium
C	Driver and operator fatigue — vehicle overturning or collision on steep narrow mountain roads	Drivers, plant operators, other workers, road users	H	H	H	H	MAJ	ST	INT	H	POSS	High
C	Worker accommodation conditions — sub-standard sanitation, ventilation, fire safety, or potable water in construction camps; mental health risks from isolation, fatigue, and family separation	Workers in construction camps; non-local workforce on extended deployments	M	H	M	H	MOD	MT	SMA	M	POSS	Medium
C	Asbestos exposure — demolition of legacy Soviet-era culverts and structures along the corridor with potential ACM content	Demolition and earthworks crews; nearby workers	M	H	M	H	MOD	LT	SMA	M	POSS	Medium



Phase	Potential Impact	Receptors	No.	Sens	Concern	Legal	Mag	Time	Spatial	Cons	Prob	Sig
O	Operations and maintenance OHS risks — routine and emergency maintenance, snow clearance, bridge inspection in flowing river, slope and rockfall response, lone working in remote sections	Road operator maintenance staff	M	H	M	M	MOD	LT	INT	M	POSS	Medium

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minor / LT: Long term / MT: Medium Term / ST: Short term / SMA: Small / INT: Intermediate / EXT: Extensive / DEF: Definitely / POSS: Possible / UNLIKE: Unlikely. Phase: C = Construction; O = Operation. (+) denotes positive impact.



7.17.5. Mitigation and Monitoring Measures

Pre-Construction Phase

Contractor OHS Plan — The Contractor shall prepare and implement a Contractor OHS Plan (CESMP-01) before any construction commences. The Plan shall set out the OHS management system, risk assessment framework, Permit to Work (PTW) procedures, Job Safety Analysis (JSA) requirements, training and induction programme, PPE specifications, emergency preparedness and response, and reporting protocols. The Plan shall be submitted to the Engineer for approval before mobilisation.

Camp Establishment Standards — Construction camps shall be established and equipped before any residential workers are accommodated. Camp standards shall comply with IFC EHS Guidelines on Worker Accommodation and shall provide: adequate sleeping space, potable water meeting national standards and WHO guidelines, sanitation facilities at adequate ratios, food provision, recreational facilities, fire safety provision, ventilation, and first aid and medical support. Camps shall be inspected and signed off before any workers take residence.

Pre-Demolition ACM Survey — All legacy Soviet-era structures along the corridor that may contain asbestos shall be subject to a pre-demolition ACM survey before demolition commences. Where ACM is identified, demolition shall be undertaken by a licensed asbestos contractor under containment, with controlled disposal to a licensed facility and air clearance monitoring before reoccupation.

Communication System Assessment — Before mobilisation, the communication system reliability along each section of the alignment shall be assessed, and satellite phones or radio equipment provided to all work fronts lacking reliable mobile coverage. Check-in intervals for isolated work fronts shall be defined in CESMP-01.

Emergency Preparedness — Emergency response arrangements shall be developed before mobilisation, including casualty evacuation routes from each section of the corridor, designated rendezvous points, helicopter landing zones where feasible, hospital coordination, and a drill schedule.

Construction Phase

OHS Management System — Mandatory ESHS induction for every worker — including subcontractor workers and visitors — is required before first day on site. Daily toolbox talks per work front, tailored to that day's specific activities, are mandatory throughout the contract. A Permit to Work system is required for all high-risk activities: bridge construction, in-stream works, blasting, works near power lines, confined spaces, lifting operations, and night works near communities. Monthly safety meetings, monthly emergency drills, and 24-hour fatality notification to PIURR and EBRD are required. The Contractor shall supply the CESMP to all subcontractors and require each to appoint an on-site safety representative.

High-Risk Activity Controls — A task-specific Job Safety Analysis or Method Statement is required for every high-risk activity, prepared, reviewed by the ESHS Manager, and communicated to workers via toolbox briefing before commencement. Only certified shotfirers may undertake blasting; only certified operators may operate plant. All lifting operations require certified gear with current inspection records and a lifting plan. Fall protection — 100% tie-off at all heights above the project-defined threshold — applies throughout. A dedicated River Protection Supervisor shall be present during all in-stream works and riverbed extraction. Lock-out/Tag-out procedures apply to all electrical and mechanical isolation. Slope and rockfall pre-shift inspections shall be undertaken at all locations where workers operate beneath active cut slopes.

Extreme Heat and Cold Stress Management — Heat stress action levels defined in CESMP-01 shall specify work/rest ratios and hydration requirements at each temperature threshold. Outdoor heavy work shall be prohibited between 12:00 and 15:00 when air temperature exceeds 40°C, with activities rescheduled to early morning and evening shifts. Shaded rest areas and cold drinking water shall be



provided at every work front during summer. For winter operations, cold weather working procedures in CESMP-01 shall define minimum clothing standards, work/rest schedules, and cold-weather stop-work criteria. Check-in intervals for isolated work fronts shall be defined in CESMP-01 and enforced via radio or satellite phone.

Driver and Operator Fatigue Management — Maximum driving and operating shift hours shall be defined in CESMP-01 with reference to national regulations and GIIP, with mandatory rest breaks and prohibition on driving after defined continuous hours without rest. All drivers and equipment operators shall be specifically inducted on local mountain conditions, gradient limits, river crossings, and community safety risks before commencing operations. Pre-shift fitness checks shall be conducted and recorded. The prohibition on night driving by construction vehicles without prior written Engineer approval applies to all drivers and is a primary fatigue risk control.

Worker Accommodation Standards (Occupational Dimension) — Camps shall be inspected monthly against IFC EHS Worker Accommodation guidelines, with non-conformances rectified before the next inspection cycle. Quarterly worker satisfaction surveys, including anonymised mental health indicators, shall be conducted by the Contractor and reported to the Engineer. Mental health awareness shall be included in induction and at quarterly toolbox talks. Family contact arrangements, including reliable communication facilities at each camp, shall be provided. Workers shall have access to the Worker GRM and the confidential reporting channel for OHS and accommodation concerns; no retaliation for raising OHS concerns is permitted under any circumstances.

Asbestos Management — Where pre-demolition survey identifies ACM in legacy structures, demolition shall be carried out by a licensed asbestos contractor under containment, with workers in appropriate respiratory PPE, controlled disposal to a licensed facility, and air clearance monitoring before reoccupation. Records of survey, removal, disposal, and clearance shall be maintained and made available to the Engineer.

Operations Phase

Operations and Maintenance OHS Management — Before handover, the road operator shall develop an OHS management system covering routine and emergency maintenance, snow clearance, bridge inspection in flowing river conditions, slope and rockfall response, and lone-working procedures for remote sections. Seasonal risk assessments and emergency response arrangements shall be in place prior to operations commencing. First-year incident statistics shall be reported as part of the annual operational E&S monitoring report.

7.17.6. Residual Impacts

Table 107: Residual Impacts — OHS

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
C	Occupational injury and fatality	High	Residual risk reflects the inherently hazardous nature of road construction in mountain terrain and the remote setting's limited emergency response capacity. Prevention through PTW, JSA, certified operators, fall protection, and emergency preparedness is the primary obligation.	Low – Medium
C	Heat stress illness	Medium	No material residual risk with defined action levels, mandatory work/rest ratios, prohibited outdoor heavy work above 40°C, and designated heat stress first responders at every work front.	Not Significant

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
C	Cold exposure and remote-working risks	Medium	No material residual risk with cold weather stop-work criteria, mandatory check-in intervals, and satellite phone or radio provision confirmed before works commence on sections without mobile coverage.	Not Significant
C	Driver and operator fatigue	High	Residual risk reflects the inherent challenge of long shifts on steep narrow mountain roads over a multi-year construction period. Managed through shift limits, mandatory rest, pre-shift fitness checks, and the prohibition on night driving without Engineer approval.	Low – Medium
C	Worker accommodation conditions and mental health	Medium	No material residual risk with IFC EHS-compliant camp standards, periodic camp inspections, mental health awareness in induction and toolbox talks, family contact arrangements, and access to the worker GRM and confidential reporting channel.	Not Significant
C	Asbestos exposure	Medium	No material residual risk with pre-demolition ACM survey of all legacy structures, licensed-contractor removal under containment, controlled disposal, and clearance air monitoring before reoccupation.	Not Significant
O	Operations and maintenance OHS risks	Medium	Residual risk reflects the inherent hazard of mountain-corridor road maintenance. Managed through the road operator's OHS management system, lone-working procedures, seasonal risk assessments, and emergency response arrangements developed pre-handover.	Low – Medium

Note: For positive impacts (marked "+"), the residual significance is shown equal to the pre-mitigation rating, reflecting standard ESIA practice. The mitigation hierarchy (avoid – minimise – restore – offset) applies to negative impacts; for positive impacts, the project's commitments preserve rather than diminish the benefit, so the residual rating is the assessed magnitude of the positive effect rather than a reduced version of it.

7.17.7. Monitoring

Table 108: Monitoring — OHS

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Indicator
OHS performance statistics	TRIR; LTI rate; near-miss frequency; fatalities; PTW compliance rate; toolbox talk completion rate	Monthly reporting; 2-hour incident notification; 24-hour fatality notification to PIURR and EBRD	All active work fronts across 56 km corridor	Contractor (ESHS Manager); Engineer monthly review; PIURR notification for fatalities and serious injuries	Monthly ESHS performance report. Incident register with root-cause analysis. Near-miss log. PTW register. Toolbox talk attendance. TRIR and LTI trends submitted to Engineer monthly.
High-risk activity compliance	JSA completion before each high-	Before each high-risk activity	Bridge sites, in-stream	Contractor (ESHS Manager);	PTW register. JSA sign-off records. Operator

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Indicator
	risk activity; operator certifications; PTW records; blasting certificates; lifting gear inspection status; fall protection compliance; confined-space atmospheric test records	(PTW); weekly audit	works, blasting locations, lifting operations, confined spaces, height works	Engineer verification for PTW sign-off	certification file. Lifting gear inspection certificates. LOTO records. Zero high-risk activity commenced without PTW sign-off.
Heat and cold stress monitoring	Air temperature and WBGT at work fronts (summer); compliance with work/rest ratios at action levels; shaded rest area and cold water provision; cold weather stop-work criteria compliance; communication system check-ins for isolated fronts	Daily during summer (Jun–Sep) and winter operations; continuous check-ins for isolated work fronts	All active work fronts; particularly upper corridor sections above km 30	Contractor (ESHS Manager); Site Supervisors at each work front	Temperature and WBGT log (daily in summer). Rest/hydration schedule compliance. Shade and water provision inspection. Cold weather stop-work records. Radio/satellite check-in log. Zero heat or cold stress illness target.
Worker accommodation standards	Compliance with IFC EHS Worker Accommodation guidelines; potable water testing; sanitation ratios; fire safety; ventilation; food provision; periodic worker satisfaction survey including mental health indicators	Monthly camp inspection; quarterly worker survey; immediate rectification of non-conformances	All construction camps along corridor	Contractor (ESHS Manager); Engineer audits; independent labour auditor	Camp inspection checklist. Potable water test results. Worker survey results (anonymised). Non-conformance closure records.
Asbestos management	Pre-demolition ACM survey results; licensed-contractor removal records; air clearance monitoring; controlled-disposal manifests	Before each demolition activity involving legacy structures; air clearance before reoccupation	All legacy culvert, bridge, and structure demolition locations along corridor	Contractor (ESHS Manager) with licensed asbestos contractor; Engineer	Pre-demolition survey reports. Removal manifests. Air clearance certificates. Disposal records to licensed facility.
Operations and maintenance OHS (handover)	OHS management system in place at handover; lone-working procedures; seasonal risk	At handover, then annual review	Road operator depot and field maintenance teams	Road operator; PIURR oversight	Handover audit. Annual OHS report. Incident statistics. Corrective action closure tracking.

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Indicator
	assessments; emergency response arrangements; first-year incident statistics				

7.18. Waste Management & Spoil Disposal

The BSK Project will generate significant waste streams across its construction corridor — dominated in volume terms by surplus cut material from road formation earthworks, and including construction waste, hazardous materials, camp domestic waste, and the possibility of encountering contaminated material in previously developed ground. The earthworks programme alone is expected to generate approximately 1.94 million m³ of excavated material across the two sections, a substantial proportion of which will require disposal once on-site reuse as fill has been maximised. Managing this volume in a remote mountain valley setting — where the Shurobdaryo runs alongside the road for most of its length and where agricultural land represents the primary livelihood of corridor communities — makes spoil disposal the highest-risk waste management issue on the project. The Law on Production and Consumption Waste regulates waste generation, handling, transport, and disposal in Tajikistan, and the EBRD ESR3 requirements apply to all waste streams generated by the Project.

7.18.1. Project Activities with Potential to result in generation of waste

The following construction activities are the primary sources of waste generation on the BSK Project:

- Road formation earthworks — grading, bank cutting, slope re-profiling, and embankment construction across the full corridor — will generate the largest single waste stream by volume. Section 1 (km 0–km 20+100) is forecast to produce approximately 781,571 m³ of excavated material; Section 2 (km 20+100–km 56+300) is forecast to produce approximately 1,158,537 m³. The design requires that a significant proportion of excavated material be reused as structural fill where material classification permits. Surplus material that cannot be reused — including material classified as unsuitable for structural fill, material from narrow cut sections where fill demand is not co-located, and overburden from borrow areas — will require disposal at approved sites.
- Demolition of existing structures — including old culvert headwalls, existing road surface fragments, and any derelict structures within the right-of-way — will generate rubble, concrete, and potentially small quantities of asphalt-containing material. Old culverts and demolished structures may contain asbestos-containing materials, particularly given the Soviet-era construction practices prevalent in the project corridor, requiring cautious investigation before demolition commences.
- Construction camp operation will generate domestic waste (food packaging, general refuse) and sewage throughout the construction period. With a workforce potentially numbering several hundred workers at peak, the volumes of domestic waste and wastewater requiring management are significant.
- Vehicle and plant maintenance and fuel handling at work fronts, refuelling points, and the construction camp will generate waste oil, oil filters, contaminated rags and absorbents, empty chemical containers, and fuel-contaminated soil from any spill events. These streams are classified as hazardous and require segregated storage and licensed disposal.



- Asphalt production and handling at the asphalt plant will generate bitumen residues, overheated or rejected asphalt mix, and contaminated equipment washings. These materials are also classified as hazardous.
- General construction activities will produce packaging materials, scrap metal, timber formwork, cable offcuts, personal protective equipment, and other solid waste across all work fronts throughout the construction period.

7.18.2. Sensitive Receptors

Shurobdaryo and tributaries — The river runs alongside the road for most of its length. Uncontrolled spoil disposal into the river or its tributaries — historically a common outcome on road construction projects in similar settings where slope-edge tipping is the path of least resistance — would directly damage aquatic habitat and adversely affect downstream water users and irrigation intakes. The river's sensitivity makes any spoil or waste entering the channel a significant compliance concern beyond its immediate physical impact.

Agricultural land and communities along the corridor — The settlements along the alignment rely on agricultural land for subsistence livelihoods. Spoil disposal on agricultural land without documented consent destroys productive capacity and creates land rights conflicts that are difficult to resolve. Communities adjacent to poorly managed spoil disposal sites are also sensitive to instability, runoff, dust, and the visual impact of unmanaged tips.

Soils and groundwater at work fronts and camps — Chronic, low-level contamination from poorly managed waste oil, chemical storage, and maintenance areas can render areas of soil unsuitable for agricultural reuse. Groundwater underlying work fronts and camps is potentially vulnerable to contamination from improperly stored hazardous waste and inadequate sewage management.

Construction workers — Workers involved in the handling and disposal of hazardous waste — including waste oil, contaminated soil, asphalt residues, and any asbestos-containing material — are directly exposed to health risks if materials are not properly classified, handled, and disposed of. Workers are the primary sensitive receptor for any unexpected contaminated material encountered during excavation.

7.18.3. Potential Impacts

Construction Phase

Spoil Disposal - The earthworks programme is the largest single waste management challenge on the BSK Project. The volume of surplus cut material is substantial, and the setting of the corridor — a narrow mountain valley with the river on one side and steep slopes on the other — limits the availability of suitable disposal sites and creates strong incentives for uncontrolled tipping. On road construction projects in similar settings in the CAREC region, there is a well-documented tendency for spoil to be tipped over the nearest convenient slope edge or into river channels when disposal is not actively managed through an approved plan with per-load tracking. In this corridor, the consequences of uncontrolled disposal are acute: tipping into the Shurobdaryo would directly impact aquatic habitat, increase sedimentation downstream, and affect irrigation intakes; tipping on steep slopes can generate secondary mass movements that present hazards to communities below; and disposal on agricultural land without consent causes irreversible loss of productive capacity and land rights conflicts.

The selection of disposal sites is constrained by topography, land tenure, proximity to the river, and slope stability. Geotechnically stable, flat or gently sloping sites with adequate separation from the river are limited along the corridor, and the Contractor will face pressure to use proximity rather than suitability as the primary criterion. The Spoil Management Plan, pre-approved disposal site register, and per-load tracking system are the primary controls that counteract this tendency.



Construction and Demolition Waste - General construction waste — concrete rubble, packaging, scrap metal, timber, and rejected materials — will be generated across all work fronts throughout the construction period. In a remote mountain setting with limited waste disposal infrastructure, the risk of illegal dumping along the road corridor or into the river is elevated. Demolition of existing structures presents the additional specific risk of asbestos-containing materials, which may be present in old culverts and building structures along the corridor given the Soviet-era construction history of the region. Worker exposure to asbestos during demolition without prior identification and appropriate controls is a serious occupational health risk.

Hazardous Waste - The construction fleet and camp will generate significant quantities of waste oil, oil filters, contaminated rags, fuel-contaminated soil, chemical containers, and asphalt residues throughout the construction period. These materials are classified as hazardous under Tajik national law and require licensed storage, transport, and disposal. In a remote corridor with limited waste management infrastructure, hazardous waste that is not actively managed tends to accumulate at work fronts and be disposed of informally — typically by burning, burial, or tipping into drainage channels.

Unexpected Contaminated Material - Excavation adjacent to existing road infrastructure, fuel storage points, and previously developed areas may encounter contaminated soil, buried waste, or asbestos-containing material that was not identified during the baseline survey. Discovery of such material during active earthworks, if not managed through a defined stop-work and characterisation procedure, risks worker exposure, cross-contamination of excavated material intended for reuse as fill, and uncontrolled disposal of hazardous material at standard spoil disposal sites.

Camp Waste and Sanitation - A construction workforce potentially numbering several hundred workers at peak, accommodated in one or more camps along the corridor, will generate significant volumes of domestic waste and sewage throughout the multi-year construction period. Improperly managed camp waste and sewage creates disease risk for workers, water contamination risk for communities and the river system downstream of camp locations, and community nuisance that can escalate into grievances and community-contractor conflict.

Operational Phase

The operational road will generate low-level waste from vehicle use, roadside littering, and periodic maintenance activities. These are inherent characteristics of an operational road and are not expected to generate significant waste management impacts. The properly designed drainage system reduces the risk of road-surface waste accumulating in watercourses. Standard routine maintenance will include periodic roadside litter clearance.

Cumulative Impacts

No significant cumulative waste management impacts have been identified. There are no other major construction projects in the corridor that would interact with the waste streams generated by the BSK Project. The cumulative effect of the project's earthworks programme on the availability of suitable spoil disposal sites along the corridor is however a real constraint — if disposal site options are consumed early in the construction programme without adequate planning, later sections may face significantly greater difficulty in identifying approved sites.

Transboundary Impacts

All construction activities and waste disposal are located within Tajikistan. Potential transboundary impacts through contamination of the Shurobdaryo — which ultimately drains to the Panj River on the international border with Afghanistan — from uncontrolled spoil or hazardous waste disposal are addressed through the prohibition on river corridor disposal and the spill prevention measures described in the Water Resources section.



7.18.4. Impact Summary and Assessment of Significance

Table 109 provides an assessment of the significance of potential waste management and spoil disposal impacts before implementation of the proposed mitigation measures.

Table 109: Impacts and Significance – Waste Management and Spoil Disposal

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
Construction Phase												
C	Uncontrolled spoil disposal — tipping of surplus cut material into the Shurobdaryo, onto unstable slopes, or onto agricultural land without consent, generating secondary hazards, aquatic habitat damage, and land rights conflicts	Shurobdaryo and tributaries; agricultural communities adjacent to disposal sites; road users below unstable tips	M	M	M	M	MOD	ST	INT	M	POSS	Medium
C	Construction waste — uncontrolled generation and disposal of general construction waste including concrete rubble, packaging, and demolition debris, with risk	Soil; watercourses; communities along corridor	M	M	M	M	MOD	ST	INT	M	POSS	Medium

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	of illegal dumping along the 56 km corridor											
C	Hazardous waste — mishandling of waste oil, contaminated materials, fuel filters, asphalt residues, and chemical containers, with risk of soil and water contamination	Soil; Shurobdaryo; groundwater; communities	M	M	M	M	MOD	ST	INT	M	POSS	Medium
C	Unexpected contaminated material — discovery of contaminated soil, buried waste, or asbestos-containing material during excavation of existing structures and previously developed areas	Workers; soil; groundwater; communities	M	M	M	M	MOD	ST	SMA	L	POSS	Medium
C	Camp and domestic waste — improper disposal of domestic waste	Communities near camps; groundwater; watercourses	M	M	M	M	MOD	ST	INT	M	POSS	Medium



Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	and sewage from construction camps, causing disease risk, water contamination, and community nuisance											
Operational Phase												
O	Operational road-surface waste and maintenance waste — accumulated waste from vehicle use, minor maintenance, and roadside littering over the operational life of the road	Roadside environment; drainage system; Shurobdaryo	L	L	L	L	MIN	LT	SMA	L	DEF	Low

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minor / LT: Long term / MT: Medium Term / ST: Short term / SMA: Small / INT: Intermediate / EXT: Extensive / DEF: Definitely / POSS: Possible / UNLIKE: Unlikely. Phase: C = Construction; O = Operation.



7.18.5. Mitigation and Management Measures

Pre-Construction Phase

Waste Management Plan — The Contractor shall prepare and implement a Waste Management Plan as part of CESMP-05 before any construction commences. The plan shall identify all anticipated waste streams by type, estimated volumes, classification (general, recyclable, hazardous), proposed disposal routes, and licensed contractors for each stream. The waste hierarchy — prevention, minimisation, reuse, recycling, then disposal — shall be applied to all streams. The plan shall be submitted to the Engineer for approval before any works commence. Camp waste management arrangements are covered by CESMP-09 and shall be approved concurrently.

Materials Balance Plan and Spoil Disposal Site Register — Before earthworks commence in each section, the Contractor shall prepare a Materials Balance Plan quantifying estimated cut volumes by material classification, fill demand, and the resulting net surplus requiring disposal and net deficit requiring external borrow. Maximising direct reuse of cut material as fill — and thereby minimising both borrow demand and spoil disposal volumes — is the primary earthworks material strategy. The Materials Balance Plan shall be reviewed and approved by the Engineer before earthworks commence in each section, and updated monthly as actual volumes diverge from forecast. All proposed spoil disposal sites shall be assessed against the siting criteria in Annex 6 of the ESMP and submitted to the Engineer for approval before any disposal commences. Approved sites are listed in the Spoil Disposal Site Register. Absolute exclusions from the register — binding regardless of site pressure — are: the Shurobdaryo corridor; slopes exceeding 30°; agricultural land without documented landowner consent and an agreed reinstatement plan; and any area within a mapped flood zone.

Asbestos Investigation Before Demolition — Before the demolition of any existing structure or culvert — particularly those of Soviet-era construction — a visual inspection shall be conducted by a qualified person to identify potential asbestos-containing materials. Where asbestos is suspected, a licensed asbestos inspector shall conduct a formal assessment before demolition commences. Workers are briefed on asbestos identification at induction and in toolbox talks, and are instructed to stop work immediately and notify the ESHS Manager if suspected asbestos-containing material is encountered during excavation.

Construction Phase

Engineered Placement and Per-Load Tracking — All spoil disposal shall be to Engineer-approved sites listed in the Spoil Disposal Site Register. Spoil shall be placed in engineered layers not exceeding 500 mm compacted thickness — random tipping or end-tipping over slopes is prohibited without exception. Perimeter drainage and toe protection shall be installed progressively as disposal proceeds. Geotechnical stability assessments are required for any disposal site with a total capacity exceeding 5,000 m³. A per-load spoil tracking register shall be maintained throughout construction recording the origin section, volume, material class, vehicle registration, driver, and disposal site for every load. The register shall be submitted to the Engineer monthly and must demonstrate that no loads have been disposed of outside the approved site list.

Progressive Rehabilitation and Weekly Inspections — Disposal sites shall be progressively rehabilitated and re-vegetated on completion of each phase rather than deferred to project end. Topsoil stripped from disposal site areas before filling commences shall be segregated and stored for final reinstatement. Disposal sites shall be inspected weekly and after every rainfall event exceeding 10 mm for signs of slope instability, erosion, perimeter drainage overtopping, and toe protection failure. Any deficiency shall be remediated within 24 hours of identification.

Segregation and Licensed Disposal — All waste shall be segregated at source into general, recyclable, and hazardous streams in clearly labelled, covered, tip-proof, weatherproof, and scavenger-proof containers at all work fronts and the construction camp. Containers shall be inspected for integrity regularly and replaced immediately when damaged. Non-hazardous construction and demolition



waste shall be removed by licensed contractors to approved facilities with transfer notes issued per load. Open burning of any waste material is absolutely prohibited on site and in its surroundings. A waste register recording type, quantity, contractor, and disposal destination shall be maintained for all streams and submitted to the Engineer monthly.

Concrete and Asphalt Residues — Concrete equipment shall be washed out only at designated washout areas with impermeable lining and settlement chambers — no concrete washwater shall reach any watercourse, drain, or soil within 50 m of a watercourse. Rejected or overheated asphalt mix and bitumen residues are classified as hazardous waste and must be stored in designated bunded areas and disposed of through licensed contractors with hazardous waste manifests.

Classified Storage and Licensed Disposal — Hazardous waste — including waste oil, oil filters, contaminated rags and absorbents, fuel-contaminated soil, empty chemical and fuel containers, and asphalt residues — shall be stored in a dedicated bunded, locked area on an impermeable base, physically separated from general waste. Hazardous waste streams shall not be mixed with each other or with general waste. Disposal shall be through state-licensed hazardous waste contractors with waste manifests issued per disposal event. Waste oil manifests shall record volume, origin, contractor name, and disposal facility for each collection. No hazardous waste shall be burned, buried, or disposed of at general or spoil disposal sites under any circumstances.

Unexpected Contaminated Material Procedure — Where visual signs of contamination are encountered during excavation — including staining, odour, unusual discolouration, or unexpected buried material — works in the affected area shall cease immediately, the area shall be isolated and secured, and the ESHS Manager shall be notified within 2 hours. The Committee for Environmental Protection shall be notified where required by national law. Material shall be characterised by sampling before any handling or disposal decision is made. Characterised material shall be disposed of via a licensed hazardous waste contractor with manifests, classified as hazardous waste regardless of source. Such material shall not be reused as fill or deposited at standard spoil disposal sites under any circumstances.

Domestic Waste and Sewage Management — Domestic waste shall be collected in lidded, scavenger-proof containers and removed to an approved landfill by an authorised contractor, with licensed landfill receipts retained as evidence. Sewage from camps with fewer than 150 workers shall use properly designed septic systems with licensed removal of liquid waste by tanker. Larger camps shall use on-site treatment systems or licensed transport, with sewage sludge classified and disposed of as hazardous waste. Construction workers shall receive training on waste management procedures at induction and at monthly toolbox talks throughout the construction period, in accordance with ESMP Annex 5 Section 11.

Demobilisation and Site Clearance — Before the Taking-Over Certificate is issued, the Contractor shall ensure all waste generated during construction has been appropriately managed and all waste storage areas cleared. A final Waste Register summary covering total waste generated by stream and disposal route over the full construction period shall be prepared and submitted to the Engineer. A joint final site waste clearance inspection shall be conducted by the ESHS Manager and the Engineer, with written sign-off required before the Taking-Over Certificate is granted, in accordance with ESMP Annex 5 Section 12

7.18.6. Residual Impacts

Table 110 provides an assessment of residual waste management and spoil disposal impacts following implementation of the mitigation measures described above.

Table 110: Residual Impacts – Waste Management and Spoil Material

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
C	Uncontrolled spoil disposal	Medium	Residual risk reflects the inherent challenge of managing large volumes across a 56 km remote corridor where site pressure to use proximity over suitability is real. Per-load tracking and the mandatory approved site register are the primary controls; their consistent application determines whether residual risk stays at Low.	Low
C	Construction waste	Medium	No material residual risk with mandatory segregation, licensed removal with transfer notes per load, and absolute prohibition on open burning and illegal dumping.	Not Significant
C	Hazardous waste	Medium	Residual risk from a low-probability storage or handling failure cannot be entirely eliminated. Licensed disposal with manifests per event and zero tolerance for mixing with general waste are the key remaining controls.	Low
C	Unexpected contaminated material	Medium	No material residual risk with mandatory stop-work, 2-hour Engineer notification, characterisation before handling, and licensed hazardous waste disposal. Workers are briefed on asbestos identification at induction.	Not Significant
C	Camp and domestic waste	Medium	No material residual risk with licensed landfill disposal, septic or treatment systems for sewage, and monthly toolbox talks maintaining worker awareness throughout the construction period.	Not Significant
O	Operational road-surface waste and maintenance waste	Low	Standard routine maintenance includes periodic roadside litter clearance. The drainage system prevents accumulation of road-surface waste in watercourses.	Not Significant

7.18.7. Monitoring

Table 111 summarises the waste management and spoil disposal monitoring requirements for the Project.

Table 111: Monitoring – Waste Management and Spoil Material

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Notes
Construction Phase					
Spoil disposal compliance	Per-load spoil tracking register (origin, volume, material class,	Per load (tracking register); weekly site	All active spoil disposal sites along corridor	Contractor (ESHS Manager); Engineer sign-	Spoil tracking register per load submitted monthly to Engineer. Approved disposal site list with

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Notes
	disposal site); zero disposal to river corridor, slopes >30°, or agricultural land without consent; disposal site stability — slope condition, perimeter drainage, and erosion	inspection; triggered after any rainfall ≥10 mm		off on disposal site list before first use	Engineer sign-off on file before use. Weekly disposal site inspection records with photographs. Zero unapproved disposal incidents — any incident triggers immediate stop-work and Engineer notification.
Materials Balance Plan adherence	Actual cut volumes versus forecast by material class; actual reuse as fill versus planned; net surplus to disposal versus forecast; any changes to disposal site locations or volumes	Monthly reconciliation against Materials Balance Plan; updated before earthworks commence in each new section	Full 56 km earthworks programme — all cut and fill locations	Contractor (ESHS Manager); Engineer review	Monthly materials balance reconciliation report submitted to Engineer. Any material divergence from approved plan (>10% variance in disposal volume or new disposal site requirement) requires Engineer approval before continuing. Submitted as part of monthly ESHS performance report.
Waste management compliance	Waste register completeness (type, quantity, contractor, destination for all streams); container integrity and labelling; licensed contractor documentation and state certificates; transfer notes per load; zero open burning; zero illegal dumping	Daily housekeeping inspection; weekly waste register review; monthly reporting to Engineer	All work fronts and construction camp(s)	Contractor (ESHS Manager); Engineer spot audits	Waste register (all streams, up to date) — submitted monthly to Engineer. Licensed contractor documentation and certificates on file. Hazardous waste manifests per disposal event. Transfer notes per load for non-hazardous waste. Daily housekeeping inspection records. Zero open burning and zero illegal dumping — both trigger immediate stop-work.
Hazardous waste handling and storage	Bund integrity and containment adequacy; MSDS folder completeness; drip tray inspection and emptying; hazardous waste manifest compliance; 2-hour incident notification compliance	Daily containment inspection; weekly formal audit; triggered by any spill or discovery of contaminated material	All fuel storage areas, workshops, refuelling points, asphalt areas, and hazardous waste storage at camp and work fronts	Contractor (ESHS Manager); Engineer verification	Daily containment inspection records. Bund sizing calculations on file. MSDS folder accessible. Drip tray inspection and emptying log. Hazardous waste manifest per disposal. 2-hour incident notification records. Contaminated material discovery: stop-work record, characterisation sampling, licensed disposal manifest, and CEP notification where required.
Camp waste and sanitation	Domestic waste records (licensed landfill receipts); sewage	Weekly camp waste inspection; bi-monthly	All construction camps	Contractor (ESHS Manager)	Licensed landfill receipts for domestic waste per collection. Sewage removal manifests for liquid waste. Bi-monthly training and

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Notes
	system type, capacity, and removal manifests; monthly toolbox talk records on waste management and pollution prevention; camp waste container condition	training records; monthly reporting			drill attendance records. Camp waste container inspection log (weekly). Monthly camp waste compliance summary in ESHS performance report.

7.19. Cultural Heritage

The BSK corridor passes through Khatlon Region, one of the most historically layered areas of Tajikistan and the heartland of the medieval Khuttal Kingdom. While no previously recorded archaeological sites have been identified within the proposed right-of-way, the depth and diversity of human occupation across the region — from Palaeolithic hunter-gatherer camps through Iron Age citadels, Buddhist monasteries, and medieval palace-cities to Soviet-era collective farms — means that undiscovered cultural heritage receptors must be considered a realistic possibility in areas of ground disturbance along the alignment. The cultural heritage assessment was conducted by a specialist cultural heritage consultant and draws on desk-based research, satellite imagery review, and regional and national archaeological and built heritage records.

7.19.1. Project Activities with Potential to affect cultural heritage

The following construction and operational activities have the potential to affect cultural heritage receptors:

- Ground-disturbing construction activities — including road grading, bank cutting, excavation, culvert and bridge installation, borrow area extraction, construction camp establishment, laydown areas, slope cut and stabilisation, and upgrading of access tracks — could cause irreparable and permanent damage to undiscovered archaeological resources if present within the project footprint.
- Temporary increases in noise, dust, and viewshed changes from construction equipment could negatively affect the setting of built and living heritage receptors, impacting the ability of stakeholders to use them for cultural and religious purposes, and affecting the practice of intangible cultural heritage.
- Ground-borne vibrations from the movement and operation of heavy construction equipment present a risk of physical damage to built and living heritage structures within 100 m of active works. Built heritage resources with unreinforced masonry, historic plaster finishes, or shallow foundations are particularly vulnerable.
- Temporary access restrictions arising from road and track closures, safety exclusion zones, and detours could restrict stakeholder access to built, living, and intangible heritage receptors and to the geographic areas and environmental resources that support cultural practices.
- Permanent changes to the setting of identified receptors from increased operational traffic volumes, elevated ambient noise levels, and vehicle emissions could affect the cultural significance, ceremonial function, and experiential value of heritage receptors over the operational life of the road.



7.19.2. Sensitive Receptors

Kal'ai Baljuvon (built heritage — medium sensitivity) — A modern reconstruction of a traditional seventeenth-century fortress located approximately 125 m northwest of the Project start point at km 0.0 in Baldzhuvon town. Although a reconstruction rather than a preserved historic structure, the Kal'ai Baljuvon is registered by the Government of Tajikistan as a national monument on account of its association with key events of early modern Baljuvon history, including its role as the seat of power for multiple regional emirs and its capture during the Uprising of the Wose in 1888. The area around the fortress is also a high-risk zone for undiscovered archaeological deposits associated with the original historic fortress site.

Mosque near km 37 (living heritage — low sensitivity) — A community mosque identified approximately 170 m northeast of the road alignment through satellite imagery, providing daily and weekly religious services and supporting cultural continuity for local communities. Existing residential structures and planted fruit trees provide additional separation between the mosque and the road. The mosque is likely of considerable cultural significance to local stakeholders as a community religious institution, regardless of its formal sensitivity classification.

Local cemeteries (living heritage — low sensitivity) — Two cemeteries have been confirmed and their treatment agreed through the resettlement process: Cemetery Shulash (km 12+300–12+440), located on the right side of the road, and Cemetery (Mazor) Langar (km 32+280–32+600), located on the left side of the road. Both are partially within the right-of-way; no graves are located within the ROW itself. The boundary fencing of Shulash and the metal gate and stone wall of Langar will be demolished and reconstructed outside the ROW edge, in arrangements agreed with the relevant Jamoats and documented in the Route Selection Act for Section 2 and the Resettlement Plan. These two cemeteries are confirmed cultural heritage receptors for the purposes of construction management and shall be treated accordingly, with a 10 m exclusion buffer applied from the cemetery boundary. Additional cemeteries along the corridor were noted in the Initial Environmental Assessment but their locations could not be confirmed during the cultural heritage baseline; the CHSEP is required to confirm these before works reach each relevant section.

Undiscovered archaeological sites (low to medium sensitivity) — The Khatlon Region has documented human occupation from the Palaeolithic through the twentieth century, encompassing hunter-gatherer camps, farming hamlets, fortified compounds, Buddhist monasteries, and medieval palace-cities. No previously recorded archaeological sites were identified within the proposed right-of-way, but areas of elevated potential include flat river terraces within and adjacent to existing settlements, the area around the Kal'ai Baljuvon, and borrow areas on level terrain. A satellite imagery review identified possible collapsed stone foundations near Sari Khosor that warrant field investigation.

Unidentified built and living heritage (low sensitivity) — Additional unidentified receptors may exist within towns and villages along the right-of-way, including traditional Pamiri houses, historic mosques and mausoleums, stone cairns, festival grounds, and community pavilions. Stakeholder engagement through the Cultural Heritage Stakeholder Engagement Plan is required to identify these receptors before construction commences.

Intangible cultural heritage receptors (medium sensitivity) — 13 intangible cultural heritage practices inscribed on the UNESCO Representative List of the Intangible Cultural Heritage of Humanity have been identified as potentially practised in communities along the Project corridor, including Navruz, Mehregan, Sadeh/Sada, Sericulture and Traditional Production of Silk for Weaving, Chakan embroidery, Atlas and Adras fabric production, and Shashmaqom Music. All are classified as medium sensitivity by virtue of their UNESCO inscription. None of the twelve components of the Ancient Khuttal UNESCO World Heritage Property will be affected by the Project — the nearest component is located approximately 22 km east of the alignment.



7.19.3. Potential Impacts

Impact significance is assessed by combining the sensitivity of the receptor with the magnitude of the potential impact. Receptor sensitivity — Low, Medium, or High — reflects the degree of legal protection, the cultural value of the receptor to stakeholders, and its replaceability. Impact magnitude — Low, Medium, or High — reflects the intensity, extent, and duration of the change to the receptor. Vibration risk thresholds for built heritage follow published guidance: resources within 10 m of a vibration source are at high risk; 10–30 m at moderate risk; 30–100 m at low risk; and beyond 100 m at very low risk, with variation depending on soil type and building fragility.

Construction Phase

Ground Disturbance and Archaeological Resources - Ground-disturbing activities during road construction — grading, bank cutting, excavation, culvert and bridge installation, borrow area extraction, construction camp establishment, laydown areas, slope cut and stabilisation, and upgrading of access tracks — could cause irreparable and permanent damage to undiscovered archaeological resources if present within the project footprint. The areas of highest archaeological potential are the flat river terraces within and adjacent to existing settlements, the area around the Kal'ai Baljuvon at the project start, and borrow areas located on flat terrain adjacent to the river channel. The risk is lower on steep slopes, where soil profiles are typically thin, mobile, and frequently disturbed, preventing the accumulation and stratification necessary for archaeological deposits to form or survive.

Setting, Vibration, and Access Impacts - Temporary construction phase increases in noise, viewshed changes from the presence of construction equipment and personnel, and decreased air quality due to dust could negatively affect the setting of built and living heritage resources, impacting the ability of stakeholders to use them for cultural purposes and the ability of communities to practise intangible cultural heritage festivals and ceremonies such as Navruz, Mehregan, and Sadeh/Sada. Physical damage to built and living heritage receptors from temporary increases in ground-borne vibrations caused by the movement and operation of construction equipment is a risk for structures within 100 m of active construction. Temporary restrictions on stakeholder access to built and living heritage receptors and to geographic areas that support intangible cultural heritage practices may arise from road and track closures, safety exclusion zones around active construction sites, and temporary detours.

Operational Phase

Setting, Traffic, and Material Degradation - Permanent changes to the setting of built and living heritage receptors will result from increased traffic volumes near receptors during the operational phase. Accelerated material degradation of built and living heritage structures or features within 50 m of the road may occur through elevated vehicle emissions, including chemical corrosion of materials, deposition of particulate matter, and accelerated weathering and erosion. Permanent elevation of ambient noise levels from increased vehicle traffic may diminish the cultural significance, ceremonial function, or experiential value of receptors, and may affect the ability of communities to use specific geographic locations for cultural purposes. Improved connectivity may also have indirect effects on intangible cultural heritage — both positive, through facilitating access to markets for traditional producers, and negative, through enabling the introduction of cheaper substitutes for traditional crafts and accelerating exposure to global cultural influences that may reduce participation in traditional practices among younger generations.

Cumulative Impacts

Road upgrades often stimulate economic development by improving connectivity, lowering transportation costs, and attracting new investment. As access expands, surrounding areas may experience increased commercial activity, rising land values, new construction, and population growth — all of which can encroach on or disturb archaeological sites, built heritage structures, and culturally



significant landscapes, particularly in regions with limited heritage inventories or informal land-use controls. This may lead to unintentional damage to subsurface archaeological resources or alteration of historic settings over the operational life of the road. Improved connectivity may also negatively affect intangible cultural heritage by enabling the displacement of traditional crafts through cheaper substitutes and accelerating sociocultural change that reduces the transmission of traditional practices between generations. These cumulative effects are inherent to transport infrastructure improvement and cannot be entirely prevented, but their scale depends significantly on the pace and nature of economic development that follows.

Transboundary Impacts

All construction activities and road operations are located within Tajikistan. No transboundary cultural heritage impacts are anticipated.



7.19.4. Impact Summary and Assessment of Significance

Table 112 presents the cultural heritage impact assessment results, combining receptor sensitivity with impact magnitude to derive pre-mitigation impact significance for each identified and potential receptor category.

Table 112: Impacts and Significance – Cultural Heritage

Receptor	Sensitivity	Impact Description	Intensity	Extent	Duration	Magnitude Rating	Significance
Tangible Cultural Heritage							
Kal'ai Baljuvon (built heritage)	Medium	Temporary increases in noise levels and reductions in air quality during construction will alter receptor setting. Structure is a modern reconstruction at 125 m from the RoW — no direct physical impact; very low vibration risk.	Low	Low	Short-term	Low	Minor
Mosque (living heritage, km 37)	Low	Temporary construction-related noise, dust, and access limitations may disrupt religious activities. Located approximately 170 m from the RoW with residential structures and orchards providing additional buffering.	Low	Low	Short-term	Low	Minor
Cemeteries (living heritage)	Low-medium	Cemetery Shulash (km 12+300–12+440) and Cemetery (Mazor) Langar (km 32+280–32+600) are both partially within the right-of-way; no graves are within the ROW itself but boundary structures will be demolished and reconstructed. Construction works will take place directly adjacent to both cemeteries. Remaining unconfirmed cemeteries along the corridor may also be in proximity to works; magnitude for these depends on final confirmed locations. Potential impacts include vibration damage to boundary structures, noise, dust, and disruption to access and use during active works.	Medium	Low	Permanent	Low–Medium	Minor to Moderate
Undiscovered archaeological sites	Low–Medium	If present, ground-disturbing construction activities could physically damage or destroy archaeological receptors in areas of disturbance, including the RoW, construction camps, laydown areas, and borrow areas.	Low–High	Low–Medium	Permanent	Low–Medium	Minor to Moderate
Unidentified built heritage	Low	If present, construction and operation phase vibration, noise, air quality impacts to setting, and temporary restrictions on stakeholder access could affect receptor value and use.	Low–Medium	Low	Permanent	Low	Minor
Unidentified living heritage	Low	If present, construction and operation phase vibration, noise, and air quality impacts to setting, and temporary access restrictions could affect receptor cultural value and use.	Low–Medium	Low	Permanent	Low	Minor



Receptor	Sensitivity	Impact Description	Intensity	Extent	Duration	Magnitude Rating	Significance
Intangible Cultural Heritage							
UNESCO ICH receptors (13 identified; presence unconfirmed)	Medium	If practised near the Project area, construction phase noise, air quality impacts, and access restrictions to locations or materials necessary for practice could affect transmission and continuity. Operational phase improved connectivity could have positive or negative effects on traditional practices.	Low–Medium	Low	Short-term	Low–Medium	Minor to Moderate

7.19.5. Mitigation and Management Measures

The potential Project impacts on known and unidentified tangible and intangible cultural heritage receptors are managed through the development and implementation of a Project-specific Cultural Heritage Management Plan (CHMP). The CHMP is the primary instrument for cultural heritage risk management throughout the construction phase and is a condition of construction commencement. Its core elements are set out below.

Construction Avoidance Buffers and Scheduling — Avoidance buffers are to be defined, physically marked, and maintained around the Kal'ai Baljuvon, the mosque near km 37, and all confirmed cemetery locations before any construction commences in their vicinity. Buffer distances are to be established in consultation with the Cultural Heritage Monitor and, where appropriate, with the Ministry of Culture. Construction activities near these receptors are to be scheduled to avoid conflicts with significant cultural events or religious practices — in particular, heavy vehicle movements near the mosque are to avoid Friday prayers and the principal Islamic calendar dates, and works near cemeteries are to avoid periods of commemoration or active use. The SCLO is responsible for maintaining a rolling calendar of known cultural events along the corridor and for communicating scheduling requirements to the construction programme.

Cemetery Shulash (km 12+300–12+440) and Cemetery (Mazor) Langar (km 32+280–32+600) are already confirmed as cultural heritage receptors with agreed boundary treatments documented in the Resettlement Plan; these do not require further confirmation through the CHSEP but shall be included in the construction avoidance buffer and scheduling requirements from the outset. A 10 m exclusion buffer shall be applied from the boundary of each confirmed cemetery. The CHSEP confirmation obligation applies to all other cemeteries along the corridor whose locations remain unconfirmed.

Chance Finds Procedure — An EBRD ESR8-compliant Chance Finds Procedure (CFP) is to be prepared by the Contractor and approved by the Engineer before any ground-disturbing works commence. The CHM's CV shall be submitted to the Engineer for approval before mobilisation commences. The CHM is a specialist role distinct from the ESHS Manager and Ecologist and shall not be substituted without prior written Engineer approval. — primarily the flat river terraces adjacent to existing settlements, the area around the Kal'ai Baljuvon at km 0.0, and all borrow areas on level terrain. If potential cultural heritage materials are encountered during construction, works in the affected area shall cease immediately, the site shall be secured, and the CHM shall assess and document the find. The Ministry of Culture shall be notified within the timeframe required by national law. Works shall not resume in the affected area until the Ministry of Culture has provided written authorisation. All chance find records shall be maintained and reported to PIURR and the Engineer. A minimum 30 m exclusion zone shall be established around any find, extended to 50 m where human remains are discovered, consistent with the exclusion distances specified in the Chance Finds Procedure (ESMP Annex 11). The ESIA does not replicate the full CFP — the operative procedure is Annex 11, which governs all steps from discovery through Ministry of Culture notification and written clearance before works resume.

Cultural Heritage Stakeholder Engagement Plan — A Cultural Heritage Stakeholder Engagement Plan (CHSEP) is to be developed and implemented to identify and consult cultural heritage stakeholders along the Project route and near associated facilities, identify potentially affected tangible and intangible heritage receptors not captured in the desktop baseline, and develop resource-specific, culturally appropriate treatment plans in consultation with stakeholders to avoid, minimise, and mitigate impacts. The CHSEP shall be prepared before construction commences, submitted to the Engineer and PIURR for approval, and maintained as an active instrument throughout the construction period. Particular priorities for the CHSEP are: confirmation of the locations and use patterns of all cemeteries along the corridor; identification of any additional living heritage receptors (mosques, shrines, festival grounds) in the 19 settlements; and determination of whether any of the 13 UNESCO ICH receptors are practised by communities along the route.

Integration of CHSEP Outcomes into Construction Planning — The outcomes of the Cultural Heritage Stakeholder Engagement Plan are to be integrated into construction planning before any works commence in areas where additional receptors are identified. This integration covers: physical exclusion of newly identified receptors from the construction footprint where feasible; scheduling of construction activities to avoid or minimise noise, air quality, visual, and access impacts during periods when built, living, or intangible heritage is actively used or practised; and development of receptor-specific management measures, agreed in writing with affected stakeholders, before works in the vicinity of each receptor commence.

7.19.6. Residual Impacts

Implementation of the Cultural Heritage Management Plan with the measures described above will reduce the significance of all identified and potential tangible and intangible cultural heritage impacts to Minor. Table 9 presents the residual significance assessment for each receptor category.

Table 113: Residual Impacts – Cultural Heritage

Receptor	Sensitivity	Pre-Mitigation Significance	Residual Impact	Residual Significance
Kal'ai Baljuvon	Medium	Minor	No direct physical impact anticipated given the 125 m separation from the RoW. Residual setting impact from construction noise and dust is temporary and low-level.	Minor
Mosque (km 37)	Low	Minor	Residual disruption to religious activities is temporary and low-level given the 170 m separation and residential buffering. Scheduling around Friday prayers eliminates the principal risk period.	Minor
Cemeteries	Low–Medium	Minor–Moderate	No graves are within the ROW. Residual risk is confined to potential vibration damage to boundary structures and access disruption during active works at each confirmed cemetery location.	Minor
Undiscovered archaeological sites	Low–Medium	Minor–Moderate	Residual risk cannot be eliminated in advance of ground disturbance. The Chance Finds Procedure and CHM presence at elevated-risk work fronts are the primary controls; their consistent application determines residual significance.	Minor
Unidentified built heritage	Low	Minor	Residual risk depends on CHSEP outcomes. Where additional receptors are identified, receptor-specific management measures reduce risk to Minor. Where receptors remain unidentified, residual risk cannot be fully eliminated.	Minor
Unidentified living heritage	Low	Minor	As above — residual risk depends on CHSEP confirmation of additional receptors and implementation of agreed management measures.	Minor

Receptor	Sensitivity	Pre-Mitigation Significance	Residual Impact	Residual Significance
UNESCO ICH receptors	Medium	Minor–Moderate	Residual impact on ICH practice depends on CHSEP confirmation of which practices are active along the corridor. Where confirmed, construction scheduling around practice periods reduces residual impact to Minor.	Minor

7.19.7. Monitoring

Table 114 summarises the cultural heritage monitoring requirements for the Project. Monitoring during the construction phase focuses on Chance Finds Procedure compliance, avoidance buffer integrity, construction scheduling relative to cultural events, and CHSEP implementation progress. There is no separate operational phase cultural heritage monitoring programme required beyond the standard road operator maintenance inspections, which should include visual checks for any evidence of vibration damage to heritage structures within 50 m of the road.

Table 114: Monitoring – Cultural Heritage

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Notes
Construction Phase					
Chance Finds Procedure compliance	Incidence of ground disturbance in elevated-risk areas without CHM present; compliance with work-stoppage protocol; timeliness of Ministry of Culture notification and authorisation before resuming works	Continuous during all ground-disturbing works in elevated-risk areas; triggered by any chance find	All ground-disturbing activities — particularly flat river terraces, existing settlement areas, borrow pits, and construction camps	Cultural Heritage Monitor; Contractor ESHS Manager; Engineer verification	CHM daily attendance log at elevated-risk work fronts. Chance find incident register. Work-stoppage records. Ministry of Culture notification and authorisation documents on file. Monthly compliance report to Engineer.
Construction avoidance buffer compliance	Physical marking of avoidance buffers around Kal'ai Baljuvon, the mosque, and confirmed cemeteries; no encroachment within buffer zones	Pre-construction buffer establishment; weekly inspection during active works within 200 m of receptors	Kal'ai Baljuvon (125 m buffer minimum); mosque near km 37; Cemetery Shulash (10 m buffer); Cemetery (Mazor) Langar (10 m buffer); any additional cemeteries confirmed through	Contractor ESHS Manager; Cultural Heritage Monitor	Buffer marking photographs before works commence in each area. Weekly buffer inspection records. Zero buffer encroachment — any encroachment triggers immediate stop-work and Engineer notification.

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Notes
			CHSEP (10 m buffer).		
Construction scheduling compliance — cultural events	Evidence that construction activities near CH receptors are not scheduled to conflict with significant cultural events (Friday prayers, Eid, Navruz, Mehregan, local festivals); community confirmation	Monthly schedule review; triggered before each significant Islamic calendar date or confirmed local cultural event	All work fronts within 500 m of identified CH receptors	SCLO; Contractor ESHS Manager	Construction schedule cross-referenced with Islamic calendar and locally confirmed cultural event dates. Community liaison records confirming no scheduling conflicts. GRM CH-related complaints log.
CHSEP implementation progress	Completion of community consultations to identify additional CH receptors along the corridor; number of additional receptors identified; stakeholder agreements on management measures	Quarterly progress reporting; continuous community engagement through SCLO	All settlements along the 56 km corridor	SCLO; Cultural Heritage Monitor; PIURR	CHSEP implementation log. Consultation attendance and topic records. Additional receptor register. Stakeholder management agreement records. Quarterly PIURR progress report.

7.20. Community Infrastructure

Community infrastructure is the primary lens through which the BSK Project's relationship with the settlements along its corridor should be understood. The project road is not one of several routes available to these communities — it is the only surface transport link connecting approximately 6,000 corridor residents with the district centre at Baljuvon, the hospital at Shahidon, schools, markets, and the wider regional economy. The electricity supply infrastructure and piped water supply serving settlement areas run alongside and beneath the road corridor. In this context, the construction phase represents not only the physical risk of temporary access disruption but a more fundamental question of whether communities remain connected to the services on which their livelihoods and welfare depend throughout a multi-year construction programme. At the same time, the operational phase delivers transformative infrastructure improvements: year-round reliable paved access where currently no reliable route exists, LED road lighting, and replaced water supply infrastructure in settlement zones.

7.20.1. Project Activities with Potential to affect community infrastructure

The following construction activities have the potential to affect community infrastructure and access to services:

- Road construction earthworks, culvert replacement, and drainage works across the corridor — including cut and fill operations, embankment construction, and bridge works — will require periodic closures or restrictions of the only road serving corridor communities. The corridor has no alternative route; any restriction on access has the potential to affect every trip made by every resident for the duration of the closure.



- Earthworks and ground disturbance within and adjacent to settlement areas will cross, disturb, or expose irrigation channels and community water supply pipelines. The design requires replacement of the existing water pipeline in some settlement zones, using polyethylene and steel pipes between 32 mm and 280 mm diameter. Works near the existing infrastructure carry the risk of accidental damage that could interrupt water supply.
- Road construction in settlement areas will require relocation of the existing 0.4 kV overhead power line in sections where it is displaced by the new carriageway. Works in proximity to transformer substations serving communities with grid electricity carry the risk of accidental supply interruption.
- Construction of the road through the settlement areas will restrict pedestrian movement and access to school buildings, community facilities, and residential properties adjacent to the road. School access is a particular constraint: several schools are located directly alongside or accessible only via the road, and children travelling to and from school share the carriageway with construction vehicles.
- Construction plant operation — including vibratory compaction, ground-bearing loads from heavy vehicles, and blasting in rock cut sections — will generate vibration that may affect residential buildings, walls, and other community structures built directly at the roadside in settlement areas.

7.20.2. Sensitive Receptors

Communities in the upper valley (approximately km 36–km 56) — Between Dashtaro at km 36 and Mullokoni at km 54, no formed road currently exists — vehicles travel along whichever bank of the Shurobdaryo is currently dry. These communities are the most sensitive to any construction-phase access disruption and also stand to benefit most from the operational phase improvements. Under baseline conditions they cannot reliably access the hospital at Shahidon, have no all-season school access for upper-valley children, and are periodically completely isolated in winter.

The hospital at Shahidon (approximately km 31) — The only health facility along the corridor, serving communities throughout the 56 km valley. Access to the hospital for emergency medical evacuation, ambulance response, obstetric emergencies, and acute illness is a critical need that cannot be interrupted. Construction-phase restrictions on the road section approaching Shahidon from either direction must treat hospital access as an absolute constraint on closure planning.

Schools along the corridor — A school and secondary school at Shahidon (km 31), a secondary school at Aspiringon (km 41) — currently accessible only by river crossing, which the project's design addresses with a pedestrian bridge — and a further school facility at Peshtroba (km 46). Children travelling to and from school on the road are the highest-risk pedestrian category for construction traffic. School access routes require dedicated management during school hours throughout the construction period.

Irrigation channels and community water supply — Gravity-fed irrigation channels drawing from the Shurobdaryo and its tributaries serve agricultural land along the corridor. Disruption to irrigation during the growing season (approximately April–September) can cause crop losses within the same growing season that cannot be recovered. The piped water supply in settlement areas serves communities for domestic use; any interruption requires an immediate alternative supply. Both are pre-existing infrastructure assets that the road corridor crosses and disturbs.

Electricity supply infrastructure — Grid electricity is present along the corridor, supplied via transformer substations at 10/0.4 kV. The 0.4 kV overhead power line in settlement areas is displaced by the new carriageway in some sections and must be relocated as part of the project scope. Transformer substations represent single points of failure for communities dependent on grid supply.



The formerly operational 20 kW micro-hydro station at approximately km 17.7 is currently non-operational; no alternative off-grid supply exists for communities in the event of grid disruption.

Community structures in settlement areas — Residential buildings, perimeter walls, fences, and gates in the settlements are built directly at the roadside in many locations. The narrow valley geometry means that separation between the road formation and existing structures is minimal. These structures are potentially vulnerable to vibration and ground movement from construction plant, and to physical contact with construction vehicles on the narrow haul route through settlement areas.

7.20.3. Potential Impacts

Construction Phase

Disruption to Road Access - The construction programme in a narrow mountain valley will require active management of vehicle movements and road closures throughout a multi-year construction period. Because there is no alternative route, any road closure — however short — affects the entirety of a community's surface transport options. The consequences range from inconvenience for routine trips to potentially serious outcomes for medical emergencies, school access, and time-sensitive agricultural activities. The upper valley communities between km 36 and km 56, which currently have no formed road at all, are particularly sensitive: even a temporary closure of a partially constructed road section may leave them worse off than the baseline if the construction prevents use of the informal river-bed route they currently depend on.

Damage to Irrigation and Water Supply Infrastructure - The alignment crosses multiple irrigation channels and runs adjacent to or above community water intakes along the corridor. Road widening, culvert replacement, and drainage works have the potential to physically disrupt or damage irrigation channels, intake structures, or the existing piped water supply. During the irrigation season (approximately April to September) even a short interruption to water supply can result in crop losses that are not recoverable within that growing season. There is no alternative supply infrastructure in this remote mountain valley that could substitute for disrupted surface water access at short notice.

Electrical Supply Disruption - Works in the vicinity of the existing 0.4 kV overhead power line and transformer substations carry the risk of accidental electrical supply interruption. The overhead power line must be relocated in sections where it is displaced by the new carriageway; during this relocation, supply to communities served by the affected line must be maintained or an alternative arrangement provided. Unplanned outages caused by construction plant contacting overhead lines, or by ground disturbance affecting underground cable connections to substations, are a realistic risk on a narrow mountain road corridor where working clearances are constrained.

Pedestrian Access and School Safety - Construction works in settlement areas will restrict pedestrian movement along and across the road. The combination of narrow working widths, heavy vehicle movements, and open excavations adjacent to residential frontages creates conditions that are particularly hazardous for children. Several schools are located directly alongside the road; children travelling on foot before and after school share the road surface with construction vehicles. The risk is highest at settlement entry and exit points where vehicle speeds tend to be higher, and during materials haulage operations through settlement areas.

Physical Damage to Community Structures - Residential buildings, walls, and fences in settlement areas along the corridor are built directly at the roadside, with separation distances of one to two metres or less in some locations. Vibratory compaction, pile driving at bridge locations, heavy vehicle loads on the road, and blasting in rock cut sections all generate ground-borne vibration that can cause cracking or structural damage to buildings with masonry construction and shallow foundations.

Loss of Emergency Air Access — Demolition of Helicopter Landing Pad — The helicopter landing pad at km 30.6–32.0, located on government-managed land adjacent to the alignment, will be demolished



as part of the construction works. According to the local community these pads are only used during presidential visits.

Operational Phase

The operational phase delivers the project's principal development purpose: year-round reliable paved access for approximately 6,000 corridor residents. For communities in the upper valley this represents a transformation — from seasonal isolation and river-bed travel to all-season paved road connection. Access to the hospital at Shahidon, which is currently materially constrained or impossible during adverse weather for upper-valley communities, will be reliable throughout the year. Emergency medical evacuation and ambulance response will be possible for the first time for these communities.

Cumulative Impacts

The BSK road is the only route in this valley. There are no other infrastructure projects that would interact cumulatively with the access disruption impacts during construction. The cumulative effect of the project's construction period on community welfare is however a genuine concern — the longer the construction programme, the longer the period during which access management obligations must be maintained at the standard required, and the greater the fatigue risk for the communities and contractor alike. This reinforces the importance of section-by-section construction sequencing that minimises the duration of any single community's exposure to disrupted access conditions.

Transboundary Impacts

All construction activities and infrastructure are located within Tajikistan. No transboundary impacts on community infrastructure are anticipated.



7.20.4. Impact Summary and Assessment of Significance

Table 115 provides an assessment of the significance of potential community infrastructure and access impacts before implementation of the proposed mitigation measures. Both negative construction-phase impacts and positive operational-phase outcomes are assessed. Positive impacts are indicated by '+' in the Significance column.

Table 115: Impacts and Significance – Community Infrastructure

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
Construction Phase												
C	Temporary disruption to road access — construction works, closures, and diversions restricting access to schools, the hospital at Shahidon, and markets for communities along the corridor, including communities in the upper valley that have no alternative route	All 19 settlements along 56 km corridor; school pupils; patients requiring hospital access; households dependent on markets	H	H	H	-	MAJ	ST	SMA	M	DEF	Medium
C	Damage to irrigation channels and	Dehkan farmers; households	H	H	H	-	MAJ	ST	SMA	M	DEF	Medium

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	community water supply infrastructure — earthworks and ground disturbance disrupting or damaging gravity-fed irrigation systems and the piped water supply serving settlement areas	dependent on irrigation; communities with piped water supply										
C	Disruption to electrical supply — temporary loss of power during relocation of the 0.4 kV overhead power line in settlement areas and during works near existing transformer substations	Communities with grid electricity connection; any community services dependent on electrical supply	H	H	H	-	MAJ	ST	SMA	M	DEF	Medium
C	Disruption to pedestrian access and school safety	Children and school pupils; elderly and mobility-	H	H	H	-	MAJ	ST	SMA	M	DEF	Medium

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	— construction works restricting pedestrian movement in settlements, particularly at school access points during start and finish times	impaired residents; pedestrians in settlement areas										
C	Physical damage to community structures — construction plant and vibration causing damage to residential buildings, fences, walls, and other community structures adjacent to the narrow road corridor in settlement areas	Residents of properties adjacent to the road in settlement areas	M	H	M	M	MOD	ST	SMA	M	POSS	Medium
Operational Phase												
O	Permanent improvement to road access — year-round	All corridor communities; women; children;	H	H	H	L	MAJ	LT	INT	H	DEF	+

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	reliable paved road connection replacing the current seasonally impassable track, materially improving access to schools, hospital, markets, and services	elderly; households previously isolated in winter										
O	Improved access to the hospital at Shahidon and emergency medical services — reliable year-round road enabling ambulance access and emergency medical evacuation for communities in the upper valley currently unable to access medical services during	Upper valley communities (approx. km 36–56); obstetric and emergency patients	H	H	H	L	MAJ	LT	INT	H	DEF	+



Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	adverse weather											

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minor / LT: Long term / MT: Medium Term / ST: Short term / SMA: Small / INT: Intermediate / EXT: Extensive / DEF: Definitely / POSS: Possible / UNLIKE: Unlikely. Phase: C = Construction; O = Operation.



7.20.5. Mitigation and Management Measures

Pre-Construction Phase

Community Infrastructure Audit and Access Route Planning — Before construction commences in each section, the SCLO shall conduct an audit of all community infrastructure within the project footprint — irrigation channels, water intakes, water supply pipes, overhead power lines, school access routes, and community access tracks — and record their locations, the communities dependent on them, and the sensitivity to disruption. Alternative access routes for any planned road closure or restriction shall be confirmed with communities and the Engineer before works affecting access begin. All community briefings before construction commences in each section shall cover the scope and timing of works, the expected impacts on access, the mitigation measures in place, and how to raise a complaint. The SCLO shall be in post and contactable before any works commence.

Utility Coordination — Before any works commence in the vicinity of the existing 0.4 kV overhead power line or transformer substations, the Contractor shall coordinate with the relevant electricity authority to agree working procedures, confirm outage scheduling, and ensure that the power line relocation is planned and sequenced to maintain continuous supply to affected communities. Before any works near the existing water pipeline in settlement zones, the Contractor shall coordinate with the relevant water authority and community representatives to agree the sequencing of pipeline replacement, ensuring that water supply continuity is maintained or an approved alternative supply is provided throughout. Utility coordination records shall be submitted to the Engineer before works in utility proximity zones commence.

Baseline Condition Survey — Before construction commences in each settlement area, the Contractor shall conduct a photographic baseline condition survey of all structures within 50 m of the planned works, recording the pre-construction condition of residential buildings, walls, fences, and any community structures. Surveys shall be GPS-referenced and submitted to the Engineer before works commence. This baseline is the reference against which any construction-related damage claims will be assessed.

Construction

Access Continuity Obligations — Safe and continuous access to all settlements and their facilities shall be maintained at all times throughout the construction period. A minimum of 48 hours' advance notice shall be given to affected communities before any planned road closure or access restriction. Emergency vehicle access — including ambulance and emergency evacuation access to the hospital at Shahidon — shall be maintained through all active works sections at all times without exception. No planned closure shall proceed if emergency vehicle access cannot be guaranteed. If works in the vicinity of a school cannot maintain safe pedestrian access for schoolchildren, works at that location shall be suspended during school hours. This obligation is not subject to Engineer pre-approval or operational convenience, consistent with ESMP Annex 2 Section 6.2

Irrigation and Water Supply Protection — All irrigation channels and community water supply infrastructure damaged during construction shall be repaired within 24 hours of identification, with affected users notified within 24 hours of any interruption. Where temporary disruption is unavoidable, an alternative supply of equivalent quality and quantity shall be provided within 24 hours of disruption commencing and maintained until the permanent supply is fully restored. All disrupted irrigation channels, intakes, and water supply infrastructure shall be restored to pre-construction condition or better before demobilisation from each section, with written community confirmation. Pipeline replacement in settlement zones shall be sequenced to ensure continuous supply throughout the transition; no length of old pipeline shall be taken out of service before the replacement section is operational and tested.

Any works affecting irrigation channels or community water supply infrastructure shall be carried out under a site-specific method statement approved by the Engineer before works commence,



addressing how the channel or supply will be managed during works, temporary supply arrangements for affected users, and the reinstatement standard on completion, in accordance with ESMP Annex 2 Section 5.2.

Pedestrian Access and School Safety — Safe pedestrian detour routes around all road closures shall be maintained and inspected daily. Dedicated crossing marshals shall be deployed at all school entry and exit points during school start and finish times throughout all works in settlement areas. All open excavations shall be fenced before the end of each working day. No heavy vehicles shall move through settlement areas between 22:00 and 06:00 without specific Engineer approval and advance community notification.

Power Line Relocation and Outage Management — The relocation of the 0.4 kV overhead power line shall be carried out in accordance with the design drawings and with formal coordination with the electricity authority. No section of the existing overhead line shall be disturbed or made unsafe before the relocated line is operational, tested, and energised. Any planned outage required for the transition shall be notified to affected communities at least 48 hours in advance, scheduled to minimise duration, and restored before the end of the working day. Blasting operations near overhead power lines shall define exclusion zones that account for flyrock and shockwave effects on the line; no blasting shall take place closer than the minimum clearance distance specified by the electricity authority without its written consent.

Vibration Monitoring and Damage Response — Where pile driving, vibratory compaction, or blasting is planned within 100 m of any residential building or community structure in settlement areas, vibration monitoring shall be conducted at the nearest structure throughout the relevant works. If measured peak particle velocity (PPV) approaches or exceeds the applicable limit — the national SanPiN limit of 0.5 mm/s PPV or DIN 4150-3, whichever is more stringent — works shall be modified to reduce vibration levels before continuing. Any structural damage attributed to construction activities shall be reported to the Engineer within 24 hours, assessed by a qualified structural inspector, and repaired at the Contractor's cost within a timeframe agreed with the affected community.

7.20.6. Residual Impacts

Table 116 presents the residual significance of community infrastructure and access impacts following full implementation of the mitigation measures described above.

Table 116: Residual Impacts – Community Infrastructure

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
C	Temporary disruption to road access	Medium	Some temporary restriction of access is unavoidable in a linear corridor construction project with no alternative route. Residual risk is managed to Low through advance notice, confirmed alternative arrangements, and maintained emergency access — but cannot be eliminated entirely.	Low
C	Damage to irrigation channels and community water supply infrastructure	Medium	Residual risk from accidental damage during active works cannot be entirely eliminated. The 24-hour repair obligation and immediate alternative supply requirement reduce consequence. Risk is highest during the	Low

Phase	Potential Impact	Pre-Mitigation Significance	Residual Impact	Residual Significance
			irrigation season when in-season losses cannot be recovered.	
C	Disruption to electrical supply	Medium	Residual risk from unplanned outages caused by construction plant contacting overhead infrastructure cannot be entirely eliminated. Planned outages are managed through utility coordination and advance notification; unplanned outages require 2-hour Engineer notification and prompt rectification.	Low
C	Disruption to pedestrian access and school safety	Medium	Residual risk from informal access to active work areas — particularly by children — cannot be eliminated through fencing and supervision alone. Sustained vigilance throughout the construction period is the key remaining control.	Low
C	Physical damage to community structures	Medium	Residual risk from vibration at structures closest to the road formation cannot be fully eliminated. The baseline survey and vibration monitoring regime ensure that any damage is identified promptly and repaired at the Contractor's cost.	Low
O	Permanent improvement to road access	Positive	Year-round reliable road access for approximately 6,000 corridor residents, transformative for upper valley communities currently seasonally isolated.	Positive
O	Improved access to hospital and emergency medical services	Positive	Reliable year-round ambulance and emergency evacuation access for upper valley communities currently unable to reach the hospital at Shahidon during adverse weather.	Positive

7.20.7. Monitoring

Table 117: Monitoring – Community Infrastructure

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Notes
Construction Phase					
Access continuity compliance	Availability of alternative access routes before any planned closure; 48-hour advance notification compliance; emergency vehicle access maintained	Daily during any works affecting road access; triggered by any unplanned closure	All active work sections along 56 km corridor, with priority to settlement areas and the section serving the hospital at Shahidon	Contractor (SCLO and ESHS Manager); Engineer verification	Alternative route confirmation records before each closure. 48-hour notification records. Emergency access confirmation log (daily). Unplanned closure incident register. School crossing marshal

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Notes
	at all times; absence of unplanned closures without community notification; school access route availability during start and finish times				deployment records. GRM access complaints log — any complaint acknowledged within 5 working days.
Irrigation channel and water supply integrity	Pre-construction inventory of all channels and water supply infrastructure within the project footprint; condition of channels and pipes after each construction event within 50 m; 24-hour repair compliance; alternative supply provision records; community confirmation of restoration	Pre-construction inventory before works commence in each section; daily inspection during works within 50 m of known channels or pipes; triggered by any damage event	All irrigation channels and community water supply infrastructure within the project footprint along the 56 km corridor	Contractor (SCLO); Engineer verification	Pre-construction channel and water supply register (GPS-referenced, use type, dependent community) — submitted to Engineer before works commence in each section. Daily inspection records during proximity works. 24-hour repair compliance records. Alternative supply provision records. Written community confirmation of restoration before demobilisation from each section.
Utility coordination compliance — electricity	Pre-works coordination with the electricity authority before works near the overhead power line and substations; advance notification to affected communities of planned outages; duration of any outage; prompt restoration of unplanned outages	Pre-works coordination confirmed before any works within 50 m of overhead line or substation; triggered by any unplanned outage	All sections of the 0.4 kV overhead power line; transformer substations along the corridor; sections of new LED road lighting installation	Contractor (ESHS Manager); PIURR coordination with electricity authority	Utility coordination confirmation records (electricity authority sign-off before works). Advance notification records to communities. Outage duration log. Any unplanned outage reported to Engineer within 2 hours — corrective action records.
Baseline condition survey and structural damage records	Pre-construction photographic survey of all structures within 50 m of active works in settlement areas; any construction-related damage identified within 24 hours and repaired;	Pre-construction survey before works commence in each settlement area; daily inspection during active works in settlement	All structures within 50 m of active works in the 17 settlement areas along the corridor	Contractor (ESHS Manager); community members via GRM	Pre-construction survey records with photographs, GPS-referenced, submitted to Engineer before works commence in each settlement. Damage incident register — any damage reported to Engineer within 24 hours with repair timeline. GRM complaints relating to

Monitoring Type	Parameters	Frequency	Location	Responsibility	Method / Notes
	community complaint records	areas; triggered by any damage report or community complaint			property damage acknowledged within 5 working days.

8. Stakeholder Engagement

This section summarises the stakeholder engagement and public disclosure process for the BSK Road Upgrade Project. It draws from the full Stakeholder Engagement Plan (SEP), which has been prepared in accordance with EBRD Environmental and Social Requirement 10 (ESR10) and represents a standalone document issued alongside this ESIA. The section covers the consultation process and approach, engagement activities undertaken to date, planned future consultations, the information disclosure framework, and the project-level Grievance Redress Mechanism (GRM).

8.1. Overview of the Consultation Process

The Project has been classified as Category A under the EBRD ESP (2024), reflecting the scale of infrastructure works and the potential for significant environmental and social impacts along the approximately 56 km road corridor. This classification requires a full ESIA, a comprehensive SEP, and meaningful stakeholder engagement throughout all phases of the project lifecycle, including preparation, construction, and operation.

Stakeholder engagement for the BSK Project is designed to ensure that affected parties and other interested stakeholders are informed, consulted, and able to meaningfully participate in project decision-making. The engagement process follows the principles of inclusivity, transparency, timeliness, and cultural appropriateness, with particular attention to disadvantaged and vulnerable groups.

In accordance with ESR10, stakeholders have been categorised into three main groups:

- a) Affected Parties – individuals, households, businesses, and institutions directly or indirectly impacted by project activities, including adjacent residents and land users, local businesses and vendors, educational and religious facilities, road users, and construction workers;
- b) Other Interested Parties – stakeholders with roles, mandates, or demonstrated interest in the project’s design and performance, including local and regional authorities, national ministries, environmental and social regulatory agencies, civil society organisations and NGOs, protected area administrations, academic institutions, financiers, and the general public;
- c) Disadvantaged and Vulnerable Individuals or Groups – individuals or groups who may face greater barriers to participation, including women and girls, older persons, persons with disabilities (PwD), low-income households and informal workers, and internally displaced persons, refugees, and migrants.

Targeted engagement approaches have been developed for each stakeholder group, including women-only focus group discussions facilitated by female staff, home visits and small-group sessions for older persons and PwD, simplified materials and trusted intermediaries for displaced persons and migrants, and consultation scheduling outside peak business hours for informal workers. All engagement activities are designed to be PwD-accessible, with sign-language interpretation available upon request and accessible PDF and large-print formats provided as needed.

Stakeholder engagement activities are coordinated by the Project Implementation Unit for Roads Rehabilitation (PIURR) under the Ministry of Transport of the Republic of Tajikistan, with support from ESIA consultants, social specialists, and construction contractors. Feedback received through consultations is systematically recorded and reviewed by PIURR and the design and supervision consultants, with stakeholder input informing refinements to project design and environmental and social management instruments. A “You Said / We Did” matrix is prepared following major consultation and disclosure events to demonstrate how community input has been addressed.

8.2. Stakeholder Engagement Undertaken to Date

Formal stakeholder engagement was initiated in 2023. A combination of informal stakeholder meetings, institutional consultations, public consultations, expert biodiversity consultations, and a household socio-economic survey have been conducted to date. Table 118: Summary of Stakeholder Engagement Activities Undertaken to Date below provides a summary of engagement activities completed as of March 2026.

Table 118: Summary of Stakeholder Engagement Activities Undertaken to Date

Date	Type	Location	Stakeholders	No.	Key Topics	Key Outcomes / Findings
30 May 2023	Informal stakeholder meeting	Sari Khosor Hotel	Hotel manager; consultants	2+	Access conditions; tourism seasonality; road safety; service provision	Confirmed tourism potential of Sari Khosor; poor road condition limits year-round access; access improvements expected to increase visitor numbers.
8 June 2023	Informal community consultation	Qiozuno settlement	Local householder; consultants	2+	Population decline; winter isolation; access to schools and health services	Highlighted seasonal isolation and out-migration due to poor accessibility; reinforced socio-economic need for year-round access.
8 June 2023	Institutional consultation	Shahidon Office	State Entity for Protected Natural Areas; consultants	3+	Location and boundaries of Sari Khosor Nature Park; ecological sensitivity	Park passport and land-use documentation provided; need for careful consideration of indirect impacts and habitat sensitivity confirmed.
14 June 2023	Institutional consultation	Ministry of Transport (MoT)	Chief Engineer; consultants	2+	Environmental sensitivities; protected areas; project scope	Confirmed environmental constraints and regulatory considerations; alignment near nature park noted.
15–16 June 2023	Institutional consultation	Dushanbe	MoT; State Entity for Protected Natural Areas; consultants	4+	Species lists; mapping of Sari Khosor Nature Park; baseline monitoring programme	Species list shared (noted as outdated); mapping information provided; need for updated biodiversity surveys identified.
26 August 2023	Public consultation	Jamoat Baljuvon	Community members; PIURR; consultants	6	Project overview; environmental impacts; land acquisition; GRM	Community expressed strong support; concerns about road width and pedestrian safety raised.
5 September 2023	Public consultation	Hukumat Baljuvon	Local authorities; community members	19 (two meetings same day)	Design parameters; compensation principles; construction schedule	Requests for clarity on valuation methodology and timing of compensation.

Date	Type	Location	Stakeholders	No.	Key Topics	Key Outcomes / Findings
6 September 2023	Public consultation	Jamoat Baljuvon	Community members	6	Land acquisition impacts; mitigation measures	Emphasis on minimizing impact on businesses and agricultural land.
13 September 2023	Public consultation	Jamoat Sari Khosor & Shahidon	Community members	69	safety; employment opportunities	High attendance in Shahidon; interest in employment opportunities during construction; support for improved access.
9 March 2026	Expert consultation (biodiversity – flora)	Dushanbe (Academy of Sciences)	Botanical expert (Institute of Botany); consultants	2+	Distribution of Red Data Book plant species; habitat characteristics; sensitivity to construction	Preliminary list of plant species of conservation concern developed; regional distribution patterns clarified; need for potential follow-up surveys identified
10 March 2026	Expert consultation (biodiversity – mammals)	Dushanbe (Academy of Sciences)	Mammalogy expert (Institute of Zoology); consultants	2+	Mountain mammal distribution; habitat use; seasonal movements; disturbance sensitivity	Preliminary list of mammal species of conservation concern prepared; key habitats and sensitivities identified; follow-up input agreed
10 March 2026	Expert consultation (biodiversity – avifauna)	Dushanbe (Academy of Sciences)	Ornithology expert (Institute of Zoology); consultants	2+	Bird migration routes; nesting habitats; disturbance during breeding; riparian ecology	Preliminary list of bird species of conservation concern prepared; important habitats identified; recommendations for further assessment provided
March 2026 (2 nd to 3 rd & 16 th to 19 th)	Socio-economic survey (household-level engagement)	Project corridor (Baljuvon – Sari Khosor)	Affected households (49 households surveyed)	49 households (372 individuals represented)	Household demographics; income sources; land use; project impacts; road access conditions; community perceptions	Survey confirms strong reliance on seasonal income and agriculture; 4.49% of total land area affected; majority report poor road access and seasonal isolation; strong support for road improvement and expected economic benefits, including tourism
18th March 2026	Informal community consultations and structured interviews	Various Villages along the Baljuvon–Sari Khosor road corridor	Local residents (farmers, drivers, small traders)	2	Road surface condition; seasonal road closures; access to markets, health and education services; landslides and	Respondents confirmed poor road condition significantly affects daily life and market access.

Date	Type	Location	Stakeholders	No.	Key Topics	Key Outcomes / Findings
					flooding; dust impacts	
25 March 2026	Informal community consultations and structured interviews	Villages along the Baljuvon–Sarikhosor road corridor (incl. Dulongmaidon, Doshmandi, Bogizogon, Toidara, Khorma, Chiltori, Dashti Kilko, Shakhidon)	Local residents including farmers, construction workers, shepherds, small traders, drivers, and women	20 (including 5 women)	Road surface condition; travel time to district centre (~2 hours); landslides, flooding, rockfalls and mudflows; dust impacts on agriculture and housing; access to markets, health and schools; natural spring near Chiltori village	Strong community support for road rehabilitation. Key concerns: dust control, road safety for pedestrians and livestock, protection of water sources and irrigation channels. Primary recommendation: employ local labour during construction. One respondent flagged a natural spring near Chiltori requiring consideration in project design.

Public consultations held in August and September 2023 attracted a combined attendance of over 100 community members across four separate events, demonstrating strong community awareness and engagement with the project. Consultations revealed broad public support for the road upgrade, while identifying specific concerns around land acquisition and compensation timelines, pedestrian safety near settlements, the potential for construction dust and noise impacts, and the importance of maintaining road access during construction. These concerns have been incorporated into the design of environmental and social management instruments, including the ESMP and RP.

The household socio-economic survey conducted in March 2026 engaged 49 households (representing 372 individuals) along the project corridor, providing quantitative and qualitative baseline data on land use, livelihoods, project impacts, and community perceptions. The survey confirmed that approximately 4.49% of total land area within the corridor is potentially affected, that the majority of households experience poor road access and seasonal isolation, and that there is strong community support for the road improvement and its expected socio-economic benefits.

8.3. Planned Stakeholder Engagement

Further engagement activities are planned throughout the remaining ESIA preparation stage, the pre-construction phase, construction, and operation. Table 119 summarises the key planned engagement activities, their objectives, target stakeholder groups, timing, and responsible parties. All venues will be PwD-accessible, with advance notice of at least 14 calendar days provided prior to each in-person consultation.

Table 119: Planned Stakeholder Engagement Activities

Project Stage / Activity	Engagement Method	Target Stakeholders	Purpose	Timing	Responsibility
ESIA Disclosure and Scoping	Website disclosure; noticeboards; public display at jamoat offices; press notice;	General public; local residents; NGOs; academia; tourism	Inform stakeholders about the Project and ESIA process; invite comments and	At ESIA disclosure; minimum 120-day disclosure period	PIURR

Project Stage / Activity	Engagement Method	Target Stakeholders	Purpose	Timing	Responsibility
	written submissions	authorities; financiers	identify key issues		
Public Consultation Meetings during ESIA Disclosure Period	Public consultation meetings in Baljuvon and Sari Khosor jamoats; live presentation of draft ESIA findings; structured Q&A; written and verbal comment capture; women-only sessions held in parallel; meeting minutes published	Local residents; land users; local businesses; vulnerable groups; women and girls; protected area administration; tourism stakeholders; NGOs	Present draft ESIA findings to project-affected people during the disclosure period; receive and respond to public comments; record formal stakeholder input for incorporation into the final ESIA	During the 120-day ESIA disclosure period; minimum two meetings (Baljuvon and Sari Khosor jamoats); women-only parallel sessions at each location	PIURR / ESIA Consultant
Community Consultations (ESIA Stage)	Public meetings; small-group discussions; household visits where needed	Local residents; land users; local businesses; vulnerable groups	Identify local concerns on access, safety, construction impacts, and mitigation	During ESIA preparation; repeated as needed	PIURR / ESIA Consultant
Targeted Engagement with Vulnerable Groups	Women-only FGDs; home visits; small-group sessions; facilitated discussions	Women and girls; older persons; PwD; low-income households; informal workers	Ensure inclusive participation; identify differentiated impacts and mitigation measures	During ESIA and prior to construction; as needed	PIURR / Social Specialist
Tourism Stakeholder Engagement	Targeted meetings; workshops; written briefings	Tourism operators; tourism development authorities; local guides and service providers	Discuss construction scheduling, access continuity, visitor safety, and tourism opportunities	ESIA stage and prior to construction; ad hoc during construction	PIURR
Biodiversity and Protected Area Engagement	Technical meetings; expert consultations; information sharing	Protected Area Administration (Sari-Khosor); environmental NGOs; academic and	Review biodiversity risks, mitigation measures, and monitoring	ESIA stage; prior to works near protected area; periodic during construction	PIURR / ESIA Consultant

Project Stage / Activity	Engagement Method	Target Stakeholders	Purpose	Timing	Responsibility
		research institutions	related to sensitive species and habitats		
Institutional and Regulatory Coordination	Technical workshops; bilateral meetings	Ministries; CEP; local authorities; emergency services	Confirm permits, traffic management, safety measures, and institutional coordination	ESIA and design stages; as required	PIURR
Pre-Construction Disclosure	Community briefings; site signage; SMS/WhatsApp notifications	Local residents; businesses; road users	Inform stakeholders about construction schedule, traffic changes, and contacts	Prior to commencement of works	PIURR / Contractors
Construction-Phase Engagement	Fortnightly bulletins; site noticeboards; community liaison	Local residents; businesses; road users; tourism operators	Maintain information flow; manage expectations; address grievances	Throughout construction	Contractors (with PIURR oversight)
SEA/SH-Sensitive Engagement	Display of codes of conduct; confidential reporting channels; trained staff	Local communities; workers; vulnerable groups	Prevent SEA/SH risks; ensure safe and confidential reporting	Throughout construction and operation	PIURR / Contractors
Feedback and Reporting	"You Said / We Did" matrix; consultation summaries; website updates	All stakeholders	Demonstrate how stakeholder input influenced Project design and mitigation	After major consultations and disclosures	PIURR
Operation-Phase Engagement	Periodic information updates; GRM operation	Road users; communities; tourism stakeholders	Address operational issues; maintain ongoing dialogue	During operation; as needed	PIURR / Road Operator

A key milestone in the planned engagement programme is the ESIA public disclosure and consultation period. As a Category A project, the ESIA and associated environmental and social instruments –



including the ESMP, SEP, RP, NTS and ESAP – will be disclosed publicly for a minimum of 120 days, in accordance with EBRD requirements for Category A projects. A formal public consultation event will be held during the disclosure period to present findings and invite stakeholder input on the draft ESIA. Consultation outcomes will be documented in a Consultation and Disclosure Report submitted to the EBRD alongside the final ESIA.

8.4. Information Disclosure

Information disclosure is a core element of meaningful stakeholder engagement under ESR10. The objective of the Project's disclosure programme is to ensure that project-affected people and other interested stakeholders have timely access to relevant, accurate, and understandable information about the project, its potential environmental and social impacts, proposed mitigation measures, and opportunities for engagement.

Disclosure activities are guided by the principles of timeliness, accessibility, inclusivity, proportionality, and transparency. Project information will be disclosed primarily in Tajik, with Russian versions provided where relevant and English versions of key documents provided for financiers and international stakeholders. To support inclusive access, printed materials will be made available at local authority offices and community venues, and accessible formats including large print, simplified summaries, and visual materials will be provided where needed. Verbal explanations will be provided during consultations to support stakeholders with low literacy.

Disclosure channels will include the PIURR project website, local authority offices at district and jamoat level, publicly accessible community locations, site noticeboards during construction, SMS and WhatsApp notifications where connectivity is available, public meetings and consultation events, and the financiers' websites where required. Disclosure channels have been selected to ensure that stakeholders with limited internet access can still obtain project information.

Table 120: Information Disclosure Schedule below sets out the key documents and information items to be disclosed, the channels and languages for disclosure, the timing of disclosure, and responsible parties.

Table 120: Information Disclosure Schedule

Document / Item	Channel & Location	Language(s)	Timing / Updates	Responsible
Draft ESIA package (ESIA, ESMP, SEP, NTS, RP and ESAP)	Project/PIURR website; local authority offices; public venues (jamoat buildings); financiers' websites where required	Tajik; Russian; English (for financiers)	During ESIA disclosure period (minimum 120 days for Category A); updated prior to finalisation	PIURR
Consultation notices	Local authority noticeboards; community venues; project website; SMS/WhatsApp where available	Tajik (+ Russian where relevant)	At least 14 calendar days prior to each consultation	PIURR
GRM information and access details	Website; posters in affected communities; leaflets at meetings;	Tajik (+ accessible formats as needed)	Prior to construction and throughout project implementation	PIURR

	verbal explanation during consultations			
Consultation materials (presentations, handouts)	Website downloads; printed copies at meetings	Tajik; Russian; English (for financiers)	Prior to consultations where feasible; archived after events	PIURR / ESIA Consultant
Consultation minutes and attendance records	Website (engagement section); hard copies on request	Tajik (English summaries where relevant)	Within 10 working days following each consultation	PIURR / ESIA Consultant
Stakeholder comments and response matrix ("You Said / We Did") and final E&S instruments	Project website; disclosure venues; ESIA annexes	Tajik; Russian; English (summary)	Following disclosure period and ESIA finalisation	PIURR / ESIA Consultant

Following major disclosure periods, a summary of stakeholder comments and responses ("You Said / We Did" matrix) will be publicly disclosed to demonstrate how stakeholder input has informed project design and mitigation measures. Disclosure commitments will be reviewed periodically and updated as necessary to reflect changes in project design, stakeholder needs, or regulatory requirements.

8.5. Grievance Redress Mechanism

8.5.1. Purpose and Principles

In accordance with EBRD ESR10, a project-level Grievance Redress Mechanism (GRM) has been established for the BSK Project. The GRM provides a transparent, culturally appropriate, and accessible process for receiving, assessing, and resolving concerns and complaints from project-affected people and other stakeholders throughout all phases of the project lifecycle.

The GRM applies to environmental, social, land acquisition, resettlement, labour, community health and safety, biodiversity, and stakeholder engagement issues associated with the project. It operates independently of judicial and administrative remedies, which remain fully accessible to all complainants at all times.

The GRM is guided by the following core principles:

- Accessibility – available to all stakeholders, including vulnerable and disadvantaged groups, at no cost and without the need for legal representation;
- Transparency and predictability – clear procedures, responsibilities, and timelines are publicly disclosed;
- Fairness and impartiality – grievances are assessed objectively and without discrimination;
- Confidentiality and data protection – personal data are protected and sensitive cases are handled discreetly;
- Non-retaliation – complainants are protected from retaliation or adverse consequences;
- Timeliness – grievances are acknowledged and addressed within defined timeframes;
- SEA/SH sensitivity – complaints related to sexual exploitation, abuse, or harassment are handled through survivor-centred, confidential pathways.



8.5.2. Types of Grievances and Access Points

The GRM accepts grievances related to land acquisition, compensation, and resettlement entitlements; temporary or permanent access restrictions; construction impacts such as noise, dust, vibration, waste, and traffic safety; environmental impacts on water, biodiversity, and protected areas; contractor and worker conduct; stakeholder engagement and disclosure processes; and sexual exploitation and abuse/sexual harassment (SEA/SH).

Grievances may be submitted through multiple access points to ensure accessibility, including verbal or written complaints to contractor-appointed grievance focal points at worksites, submission through local jamoat or district authorities, direct submission to PIURR in person, by phone, or in writing, complaint boxes at construction sites and public locations, and anonymous submissions (including for SEA/SH-related complaints).

Information on grievance channels, contact details, and procedures is displayed at worksites, jamoat offices, and other public locations, and disseminated during stakeholder engagement activities. PIURR can be contacted directly at sharis_piurr@mail.ru or +992 933 310 011.

Personal data collected through stakeholder engagement and the GRM will be handled per national legislation and EBRD requirements; access restricted to authorised personnel; data stored securely, anonymised where appropriate, and retained only as long as necessary.

GRM information will be included in Project Information Materials, disclosed through public noticeboards and websites, and explained during engagement activities to ensure stakeholders are aware of their rights and available channels.

8.5.3. Procedures and Service Standards

The GRM follows a four-step tiered process with defined service standards:

- **Step 1 – Receipt and Registration:** All grievances are recorded in a central grievance register maintained by PIURR. Acknowledgement of receipt is provided within 5 working days.
- **Step 2 – Initial Review and Resolution:** Straightforward grievances are reviewed and addressed at contractor or local level in coordination with PIURR and the Construction Supervision Consultant. Resolution is sought within 15 working days of acknowledgement.
- **Step 3 – Escalation to District-Level GRC:** If unresolved, the grievance is referred to the District-level Grievance Redress Committee (GRC), comprising representatives of local authorities, relevant sector agencies, and PIURR safeguards staff. A written response is provided to the complainant.
- **Step 4 – PIURR-Level Review:** Complex or unresolved grievances are escalated to PIURR-level review, with independent technical experts engaged where necessary. Final project-level decisions are communicated in writing to the complainant.

Service standards include acknowledgement within 5 working days of receipt, a proposed resolution or action plan within 15 working days for straightforward cases, and resolution within 30 working days where feasible. Urgent grievances related to community safety, serious environmental incidents, OHS risks, or SEA/SH are escalated immediately and addressed as a priority. Where additional time is required, the complainant is informed in writing of the reason for the delay and the revised timeline.

8.5.4. Escalation, SEA/SH Handling and Worker GRM

At any stage, complainants may escalate their grievance to the District-level GRC, PIURR-level review, the courts of the Republic of Tajikistan, or the EBRD Project Complaint Mechanism (PCM). Use of the project GRM is voluntary and does not preclude access to any other remedies.



SEA/SH-related grievances are managed through a separate, survivor-centred process. Complaints may be submitted anonymously; no investigation or information sharing occurs without survivor consent; survivors are referred to appropriate support services where available; and SEA/SH cases are recorded only as anonymised statistics for monitoring purposes. All personnel involved in grievance handling receive training on SEA/SH risk mitigation and confidential response protocols.

A separate Worker GRM has been established in accordance with EBRD Performance Requirement 2 and the project's Labour Management Procedures. The Worker GRM covers working conditions, wages, hours, OHS, discrimination, harassment, and worker conduct, and includes multiple anonymous access channels, confidentiality and non-retaliation protections, and SEA/SH survivor-centred handling. Aggregate, non-identifying data from the Worker GRM will be reported alongside community GRM performance indicators.

8.5.5. GRM Monitoring and Reporting

GRM performance is monitored using ESR10-aligned indicators, including the number and type of grievances received, the percentage acknowledged within 5 working days, the percentage resolved within 30 working days, and the number of anonymous grievances. SEA/SH cases are reported as aggregated statistics only. Grievance data are reviewed monthly and summarised in quarterly reports to the EBRD. Aggregated GRM performance information is disclosed publicly, while ensuring confidentiality and data protection for individual complainants.

PIURR holds overall responsibility for GRM implementation, oversight, record keeping, monitoring, and reporting. Contractors serve as the first point of contact at worksites and are responsible for registering grievances and promptly informing PIURR. The Construction Supervision Consultant supports grievance assessment, site inspections, and technical reviews.

The full SEP, including the detailed GRM procedures, stakeholder engagement plan, disclosure schedule, and supporting annexes, is provided as a separate document accompanying this ESIA.

8.5.6. Resources and Responsibilities

Overall responsibility for implementation of the SEP rests with PIURR, which leads information disclosure, oversees the GRM, and coordinates engagement with government authorities, tourism bodies, protected area administrations, environmental NGOs, and academic institutions. Contractors serve as the first point of contact for community grievances at site level and are responsible for appointing grievance focal points and implementing site-based disclosure measures. The Construction Supervision Consultant supports monitoring, site inspections, and verification of engagement activities. The allocation of roles, responsibilities, and resources for SEP implementation — including budgetary provisions, training requirements, and logistical support — is set out in full in Section 9 of the SEP.

8.5.7. SEP Monitoring and Reporting

SEP implementation is monitored using indicators aligned with ESR10, covering the number and type of engagement activities conducted, participation of vulnerable groups, timeliness of disclosure, and GRM performance. Monitoring results are reported internally by PIURR on a regular basis and externally to the EBRD as part of Project environmental and social reporting. The full monitoring framework, including indicators, responsibilities, and reporting commitments, is set out in Section 10 of the SEP.

9. ESIA Implementation

9.1. Overview and Institutional Structure

Implementation of this ESIA and its associated environmental and social instruments is governed by a structured, multi-party arrangement in which each key party has defined and complementary responsibilities. The four principal parties are PIURR, the Engineer (Construction Supervision Consultant), the Contractor, and the EBRD.

PIURR is the implementing agency and the borrower's project-side environmental and social management function. It holds ownership of all project-level environmental and social instruments, and bears ultimate accountability to the EBRD for the Project's environmental and social performance under the loan agreement. PIURR does not manage day-to-day construction activities but exercises oversight through its review and approval of key documents, its receipt of consolidated reporting from the Engineer, its management of PIURR-held instruments such as the RP and SEP, and its direct reporting obligations to the EBRD.

In addition to its oversight and reporting functions, PIURR is responsible for implementing all actions assigned to the Client or PIU under the Environmental and Social Action Plan (ESAP). The ESAP forms part of the financing agreements between PIURR and the EBRD and has the same legal status as the other loan covenants. PIURR shall maintain an ESAP implementation plan with measurable delivery metrics and target dates for each action, in a format that feeds directly into semi-annual reporting to the EBRD. Where any ESAP action is at risk of delay, PIURR shall notify the EBRD promptly and agree a remediation approach. ESAP items that fall outside the construction contract — including those related to the Resettlement Plan, the Stakeholder Engagement Plan, protected area coordination, and pre-construction permitting — are PIURR's direct responsibility and cannot be delegated to the Contractor or Engineer.

The Engineer — also referred to as the Construction Supervision Consultant (CSC) — acts on behalf of PIURR as the day-to-day supervisor and independent verifier of ESHS compliance throughout the construction phase. The Engineer's authority over the Contractor is direct and contractually binding: the Engineer reviews the Contractor's CESMP and sub-plans, conducts routine and unannounced site inspections, issues non-compliance notices and corrective action instructions, and holds stop-work authority where there is an imminent risk to worker safety, community safety, or the environment. The Engineer does not, however, take on PIURR's accountability to the EBRD, and for certain decisions — particularly those involving EBRD loan covenants, Category 1 non-compliances, or approvals requiring Bank no-objection — the Engineer must refer to and act in coordination with PIURR.

The Contractor is responsible for implementing all mitigation, monitoring, and management measures assigned to it under the ESMP and its approved CESMP for the full duration of the contract. The Contractor is directly accountable to the Engineer for day-to-day ESHS compliance and to PIURR for contractual performance. The Contractor must ensure that ESMP requirements are fully cascaded to all subcontractors and workers, and must report ESHS performance monthly to the Engineer.

The EBRD is the financing institution and exercises ongoing environmental and social supervision rights under the loan agreement. EBRD does not manage day-to-day project activities but receives semi-annual Environmental Monitoring Reports, conducts periodic supervision missions, and retains the right to require corrective action plans and to suspend disbursement in the event of material non-compliance with EBRD ESRs.

The interaction between these parties follows a defined reporting and approval chain. The Contractor submits monthly ESHS performance reports simultaneously to both the Engineer and PIURR by the



fifth working day of the following month. The Engineer reviews these reports, adds its own independent compliance assessment, and forwards a consolidated monthly progress report to PIURR within ten working days of the end of each reporting period. The Engineer prepares semi-annual Environmental Monitoring Reports (EMRs) on behalf of PIURR and submits them to EBRD within 20 working days of the end of each six-month reporting period. This chain is a contractual obligation and not merely administrative practice; each party is responsible for pricing and resourcing its obligations within it accordingly.

9.2. PIURR

PIURR, operating under the Ministry of Transport of the Republic of Tajikistan, is the implementing agency for the Project and bears primary and overarching responsibility for ensuring that this ESIA and all associated environmental and social instruments are implemented effectively throughout the project lifecycle. This responsibility extends from project preparation through construction, the defects liability period, and into early operations, and cannot be delegated in full to either the Engineer or the Contractor.

9.2.1. General Responsibilities

PIURR is the owner of all project-level environmental and social instruments, including this ESIA, the ESMP, the Stakeholder Engagement Plan (SEP), the Land Acquisition and Resettlement Plan (RP), and the Labour Management Procedures (LMP). PIURR is responsible for ensuring that these instruments remain current, internally consistent, and reflective of actual project conditions as design and construction progress. In the event of any inconsistency between instruments, PIURR is responsible for issuing clarification and ensuring that the more stringent requirement is applied. Where project design changes, unanticipated impacts, or new environmental or social risks emerge during construction, PIURR is responsible for initiating updates to the relevant instruments and, where required, submitting revised documents to the EBRD for review. Any updates to the project-level ESMP shall be subject to review and approval by PIURR and the EBRD as required under the financing agreements (ESMP, Section 8.2).

Before site mobilisation commences, PIURR shall establish and operationalise a Project Environmental and Social Management System (ESMS) aligned with EBRD ESR1 requirements. The ESMS shall include documented procedures for ESHS management, reporting, and document control; a roles and responsibilities matrix for all parties; and arrangements for internal audit and management review. The ESMS shall be submitted to EBRD as part of the Inception Report and shall be operational before any site establishment or construction activities begin (ESAP, action 1.1).

9.2.2. National Permitting and State Ecological Expertise

PIURR, as project proponent, is responsible for initiating and progressing the State Ecological Expertise (SEE) review through the Committee for Environmental Protection (CEP). A positive SEE conclusion has been obtained by PIURR. No construction works shall commence until all conditions attached to the SEE conclusion have been reviewed by PIURR and incorporated into the Contractor's CESMP. The SEE conclusion is a PIURR-held approval; the Contractor's obligation is to operate within its conditions rather than to obtain it independently (ESMP, Section 3.1). Beyond the SEE, PIURR is responsible for maintaining a permit tracker covering all environmental, social, and construction-related approvals required under national law, including coordination with Basin Water Organisations for water abstraction permits, the Ministry of Culture's heritage agency for cultural heritage notifications, local Hukumats for temporary land-use permissions, the State Labour Inspectorate for labour compliance oversight, and Traffic Police for traffic management coordination (ESMP, Table 3).

9.2.3. CESMP and Sub-plan Review and Approval

Through the construction contract, PIURR delegates to the Engineer the day-to-day review and approval of the Contractor's CESMP and its topic-specific sub-plans prior to commencement of works



(ESMP, Section 8.2). However, PIURR retains approval authority in its own right for all sub-plans and must provide its own written approval alongside the Engineer for the full suite of CESMP sub-plans. For the Labour and Working Conditions Management Plan (CESMP-09), PIURR approval is required alongside Bank no-objection before works may commence. PIURR retains the right to require revision and resubmission of any sub-plan that does not meet the requirements of the ESMP, irrespective of any provisional acceptance by the Engineer.

9.2.4. Land Acquisition and Resettlement

PIURR is the sole implementing agency for the RP. It is PIURR's responsibility — not the Contractor's — to ensure that all compensation and resettlement entitlements for project-affected land users have been fulfilled for a given section of the corridor before construction works may commence on that section. No land development shall begin on any parcel until PIURR has confirmed that compensation has been paid or that alternative arrangements consistent with the RP have been completed. The Contractor must obtain written confirmation from PIURR for each section before works commence. Any instruction from the Engineer to begin works on a section where PIURR confirmation has not been issued does not override this requirement (ESMP, Section 5.3.7).

PIURR's obligations under the RP extend beyond pre-construction compensation confirmation into the construction and post-construction phases. PIURR shall monitor livelihood restoration outcomes for all directly affected parties throughout the construction period and for as long as is necessary post-construction to confirm that livelihood restoration targets have been met. Particular attention shall be given to the 40 households identified in the RP vulnerability register, who are at highest risk of long-term impoverishment without active monitoring and support. Livelihood restoration monitoring results shall be reported to EBRD semi-annually and livelihood restoration targets shall be confirmed as met before the project is closed out (ESAP, action 5.3).

9.2.5. Stakeholder Engagement and GRM Oversight

PIURR holds overall responsibility for implementation of the SEP and the project-level Grievance Redress Mechanism throughout the project lifecycle. PIURR shall appoint a dedicated Community Liaison Officer (CLO) within the PIURR team before mobilisation commences; this role is distinct from the Contractor's SCLO and holds responsibility for PIURR-level engagement and grievance oversight. PIURR's SEP implementation obligations include: planning and leading public disclosure events; coordinating quarterly community consultations during construction; convening focus groups with women and vulnerable groups at least twice per year; delivering six-monthly road safety awareness sessions at schools along the corridor; and maintaining and publicly disclosing the "You Said / We Did" consultation record following all major engagement events.

PIURR is responsible for overseeing the operation of the project-level GRM, including escalation and closure of unresolved grievances and ensuring that SEA/SH-related grievances are managed through the appropriate survivor-centred pathway. All community grievances shall be acknowledged within five working days of receipt and resolved within 30 days; grievances requiring further investigation may be extended to 30 days for straightforward matters and beyond only with documented justification and EBRD notification. The ultimate oversight and accountability for GRM performance rests with PIURR regardless of which party receives the grievance at first instance.

PIURR shall submit a semi-annual stakeholder engagement log (SE log) to EBRD covering all engagement activities, grievances received and resolved, and any outstanding issues. The SE log shall be submitted alongside the semi-annual EMR (ESAP, actions 10.1 and 10.2).

9.2.6. Reporting to EBRD

The Engineer prepares semi-annual Environmental Monitoring Reports (EMRs) on behalf of PIURR, consolidating monthly ESHS reports from the Contractor, the Engineer's own independent compliance assessment, GRM performance data, RP implementation progress, and any incident or non-



compliance records for the period. The Engineer submits completed EMRs to EBRD within 20 working days of the end of each six-month reporting period. PIURR remains accountable to EBRD for the content and timeliness of all EMRs notwithstanding the Engineer's preparation role (ESMP, Section 7).

During the operational phase, PIURR shall prepare and submit Annual Operational Monitoring Reports to EBRD within 45 days of the end of each of the first five operational years following road opening. After year five, the reporting frequency and scope shall be agreed with EBRD based on monitoring outcomes. The content requirements for annual operational reports are set out in the Operational Management Plan chapter of the ESMP.

PIURR shall notify EBRD of any Category 1 non-compliance within five working days of becoming aware, regardless of whether a corrective action plan has already been initiated. Notification shall include a description of the non-compliance, the immediate action taken, and the proposed corrective action plan with timetable and responsible parties. This five-day notification obligation is separate from and does not replace the semi-annual EMR reporting requirement (ESAP, action 1.7; ESMP, Section 8.7).

9.2.7. Independent Compliance Audit

PIURR shall commission an independent third-party environmental and social compliance audit every two years from construction commencement, covering compliance with all ESAP obligations, ESMP implementation, and EBRD ESR requirements. The audit shall be conducted by qualified auditors independent of the Contractor, the Engineer, and PIURR, and shall assess whether management plans are being implemented effectively and not merely documented. Audit reports shall be submitted to EBRD within 60 days of completion. PIURR shall prepare a corrective action plan addressing all material findings within 30 days of the audit report and implement agreed actions within the timelines specified in that plan. No material non-compliances shall remain outstanding at the time of each subsequent audit (ESAP, action 1.8).

9.2.8.

Given the Critical Habitat determination and the associated Net Gain obligation, independent biodiversity oversight will be established for the Project: an Ecologist of Record (a senior independent advisor to PIURR who signs off translocation protocols and advises on adaptive management) and an Independent Monitoring Consultant to verify implementation of the BMP, BAP and BOMP. Both will be in place before mobilisation and retained through construction and the offset implementation period.

9.2.9. Category 1 Non-compliance

For the purposes of this ESIA, a Category 1 non-compliance is defined in the ESMP as any breach of an applicable EBRD ESR obligation; any breach of national environmental or social legislation; any fatality or serious injury to a worker or member of the public; any significant environmental pollution event reaching a watercourse; any SEA/SH incident; any chance find that has not been properly managed; or any instance of construction works commencing on land for which RP compensation has not been confirmed (ESMP, Section 8.7). PIURR's obligation to notify the EBRD promptly of such events is a loan covenant and not merely an administrative requirement.

9.2.10. Staffing

PIURR shall ensure that suitably qualified and experienced environmental, social, and safeguards personnel are in place throughout the construction phase to discharge its oversight functions. These personnel are responsible for reviewing Contractor and Engineer reporting, participating in monthly ESHS meetings, conducting periodic independent site visits, coordinating with the EBRD on supervision missions, and maintaining the project's central records of all ESHS documentation, permits, grievances, and incident reports.



9.3. Engineer

The Engineer — formally the Construction Supervision Consultant (CSC) — acts on behalf of PIURR as the day-to-day supervisor and independent verifier of ESHS compliance throughout the construction phase. It is important to understand that the Engineer is not a government body and does not hold regulatory authority; its powers derive from the construction contract and from PIURR's delegation of supervisory functions. The Engineer's role is therefore one of technical oversight, verification, and enforcement within the contractual framework, rather than one of project ownership or accountability to the EBRD. Nevertheless, the Engineer carries significant operational authority over the Contractor and its decisions on ESHS matters are binding unless overruled by PIURR.

The Engineer shall assist PIURR in developing and maintaining an ESAP implementation plan specifying responsible persons, delivery timelines, and measurable metrics for each ESAP action, in a format that feeds directly into semi-annual reporting to EBRD.

9.3.1. CESMP and Sub-plan Review

The Engineer is responsible for reviewing the Contractor's CESMP and all required topic-specific sub-plans prior to commencement of works. Upon receipt of the CESMP, the Engineer shall complete its review and provide written comments or approval within ten working days. The Contractor shall address any comments and resubmit within five working days. Written approval of the CESMP and all sub-plans must be obtained at least 30 days before any site activities begin, including site establishment, preparation, or clearance (ESMP, Section 8.2). The Engineer shall not issue the Commencement Notice until the CESMP has been approved and, where required, the EBRD's no-objection has been confirmed in writing. The Contractor shall programme its mobilisation schedule on the basis that the CESMP approval process will require a minimum of 45 days from submission to approved status, and shall not compress this timeline to recover programme time.

9.3.2. Non-conformance Reporting System

The Engineer is responsible for establishing, implementing, and maintaining a formal Non-Conformance Reporting (NCR) system covering all ESHS aspects of the Project from the outset of construction. The NCR system applies not only to technical and quality issues but equally to environmental, social, labour, and OHS non-compliances. All non-conformances shall be recorded in a structured NCR register, categorised by severity as minor, major, or critical, assigned corrective and preventive actions with defined timelines, and tracked to closure and verified by the Engineer. The Contractor and Engineer shall report NCR status as part of monthly ESHS reporting. The Engineer shall immediately escalate any critical non-conformances to PIURR and the EBRD. The NCR system framework shall be submitted to PIURR and EBRD as part of the Inception Report and is subject to PIURR's approval and EBRD's no-objection before construction commences.

9.3.3. Site Inspections

The Engineer has authority to conduct routine and unannounced inspections of all construction sites, plants, camps, borrow areas, access roads, and associated facilities at any time throughout the construction phase. Inspection findings shall be documented and communicated in writing to the Contractor and to PIURR. The Engineer is responsible for verifying that ESHS mitigation measures are being implemented as specified in the CESMP and the ESMP, and that monitoring activities are being carried out at the required frequency and to the required standard. The results of inspections form part of the Engineer's monthly compliance assessment forwarded to PIURR (ESMP, Section 7).

9.3.4. Corrective Actions

The Engineer will issue written corrective action requests to the Contractor at any time during day-to-day supervision where ESHS standards are not being met. Where the Contractor fails to implement corrective actions within the defined timeframe, or where non-compliance is repeated, the Engineer shall issue a formal Notice to Correct. The Engineer also has authority to withhold payment for works



that are not being carried out in accordance with the Contract where ESHS non-compliance has been identified and not resolved (ESMP, Section 8.8).

9.3.5. Stop Work Authority

The Engineer may instruct the Contractor to immediately suspend any activity that poses an imminent risk to worker safety, community safety, or the environment, without prior referral to PIURR. Stop-work instructions issued by the Engineer are binding on the Contractor immediately upon issue and remain in force until the Engineer issues a written instruction to resume. The Contractor shall not resume suspended works on the basis of verbal instruction alone. The Engineer shall notify PIURR immediately of any stop-work instruction issued, together with the grounds for the instruction and the conditions required for resumption (ESMP, Section 8.2).

9.3.6. Design Approvals and Technical Oversight

Beyond ESHS compliance, the Engineer carries specific technical approval functions that have direct environmental relevance. The Contractor must not substitute alternative sizing, capacity assumptions, or material specifications from those established in the design without the Engineer's written approval. Prior to commencement of foundation works at each bridge, the Engineer must receive and approve site-specific geotechnical investigation results and revised pile depth calculations before works proceed. The Engineer reviews and approves the Contractor's borrow area extraction method statement, and the Contractor must not extract material from any location not pre-approved by the Engineer. In sections of the corridor near the Sari-Khosor protected area or other environmentally sensitive locations, the Engineer may specify additional mitigation requirements beyond those set out in the ESMP where site conditions require it (ESMP, Section 6.2, Design Phase).

9.3.7. Audits

The Engineer is responsible for three formal audit deliverables. A Road Safety Audit shall be commissioned and overseen prior to completion of the works; any additional safety measures identified shall be incorporated before practical completion is certified. Annual Labour Audits of the Contractor and all sub-contractors shall be conducted throughout construction, with the first audit completed no later than when the main workforce is mobilised on site; the audit format shall be submitted to PIURR and EBRD at least 30 days before the first audit and is subject to PIURR's approval and EBRD's no-objection. A Resettlement Audit shall be carried out to verify that all RP compensation and livelihood restoration obligations have been fulfilled before project close-out.

9.3.8. Monthly Reporting and Meetings

The Engineer prepares semi-annual Environmental Monitoring Reports on behalf of PIURR and submits them to EBRD within 20 working days of the end of each six-month period. The Engineer also convenes monthly ESHS meetings attended by the Contractor's management and ESHS team, at which areas for improvement, unsafe acts, non-compliances, time-bound corrective actions, and responsibilities are discussed, agreed, and documented. These monthly meetings and the associated compliance assessments form the primary mechanism through which the Engineer provides PIURR with the independent verification of ESHS performance needed for semi-annual EMR submissions to the EBRD (ESMP, Sections 7 and 8.9).

9.3.9. Supervision Missions

The Engineer supports PIURR in facilitating EBRD supervision missions, ensuring that all relevant ESHS records, monitoring data, grievance registers, incident reports, and CESMP documentation are accessible to EBRD staff upon request. For any EBRD supervision mission to ongoing works, the Engineer shall ensure that EBRD staff and consultants receive a site health and safety induction and appropriate PPE before accessing any work area (ESMP, Section 8.9).



9.3.10. Staffing

The Engineer shall maintain a dedicated ESHS team throughout the construction period proportionate to the project risk profile. As a minimum this shall comprise: a Senior Environmental Expert serving as ESHS Team Leader; an Environmental Monitoring Expert; a Social and Gender Monitoring Expert; an Occupational Health and Safety Specialist present continuously throughout construction; a Senior Resettlement Specialist available for periodic missions; and a Senior Traffic and Road Safety Expert available for periodic missions..

9.4. Contractor

The Contractor is responsible for implementing all mitigation, monitoring, and management measures assigned to it under this ESMP and its approved CESMP for the full duration of the contract, including mobilisation, construction, demobilisation, and any defects liability activities. The Contractor is directly accountable to the Engineer for day-to-day ESHS compliance and to PIURR for overall contractual performance.

9.4.1. CESMP Preparation and Maintenance

The Contractor is responsible for preparing the CESMP and submitting it to the Engineer and PIURR within seven days of the Commencement Date. Written approval of the CESMP and all sub-plans must be obtained at least 30 days before any physical site activities begin. The CESMP must demonstrate how all mitigation, monitoring, and management measures defined in the ESMP will be implemented, and must include as a minimum the sixteen topic-specific sub-plans listed in the ESMP (Section 8.2), covering occupational health and safety, community health and safety, traffic management, emergency preparedness and response, waste management, materials and borrow area management, water quality and sediment control, biodiversity management, labour and working conditions, worker accommodation and camp management, chance find procedures, worker code of conduct, air quality and dust management, noise and vibration management, erosion and sediment control, and access road management. The CESMP and its sub-plans must be reviewed and updated periodically throughout the contract period, and any revisions submitted to the Engineer and PIURR for approval before implementation (ESMP, Section 8.2).

9.4.2. Staffing

The Contractor shall establish a dedicated ESHS management structure proportionate to the project risk profile, submitted as part of the CESMP package and subject to formal no-objection by the Engineer and PIURR prior to mobilisation. As a minimum, the Contractor shall appoint a full-time Environmental and Social Manager (ESM) with at least 10 years proven experience and familiarity with IFI safeguard requirements; a part-time Ecologist specialised in species listed in the Red Data Book of Tajikistan; a full-time Health and Safety Specialist (HSS) with internationally recognised certification; dedicated Health and Safety Supervisors at a ratio of at least one per fifty workers across all active work fronts; a full-time Labour Officer responsible for the worker GRM and labour compliance monitoring; and a Social and Community Liaison Officer (SCLO) fluent in Tajik and/or Russian responsible for community engagement and the contractor's first-tier GRM function. The ESM and HSS shall have independent reporting lines to the Contractor's Project Manager and direct authority to stop works in the event of serious ESHS risk (ESMP, Section 8.4).

9.4.3. Contractors sub-contractors

The Contractor retains ultimate responsibility for ESMP implementation under the contract and must ensure that all requirements are fully cascaded to all subcontractors, suppliers, and workers, regardless of whether they are formally or informally employed. The Contractor must supervise and monitor subcontractor compliance accordingly. All workers must comply, in their conduct and work practices, with all environmental, health, and safety instructions issued by the Contractor. Each



subcontractor shall appoint a designated on-site safety representative. The Contractor shall verify that no subcontractor uses child or forced labour at any tier of the supply chain.

9.4.4. Permits and Legal Compliance

The Contractor is responsible for obtaining all Contractor-held permits and approvals prior to commencement of related works, including borrow area licences, air emission permits, water abstraction approvals, and waste disposal arrangements, and for providing copies of all permits to PIURR and the Engineer. The Contractor must ensure full compliance with all applicable environmental, social, labour, public health, and occupational safety legislation of the Republic of Tajikistan, as well as with EBRD ESR requirements and applicable Good International Industry Practice (GIIP). Where national standards are less stringent than EBRD ESR requirements or IFC EHS Guidelines, the more stringent standard applies (ESMP, Section 3).

9.4.5. Monthly Reporting

The Contractor shall submit monthly ESHS performance reports to the Engineer by the fifth of the following month, covering implementation of mitigation measures, monitoring activities and results, incidents, near-misses and corrective actions, grievances received and resolved, and non-compliances and follow-up actions. The Contractor shall also maintain complete photographic records of all site activities, key locations, and environmental conditions, and shall submit geo-referenced photographs alongside monthly reports (ESMP, Section 8.3).

9.4.6. Incident Notification

For any fatality or incident involving multiple serious injuries requiring hospitalisation, the Contractor shall notify the Engineer and PIURR immediately and shall ensure that detailed information is provided to PIURR for onward transmission to EBRD within three working days. For labour-related incidents — including worker strikes or labour unrest, SEA/SH allegations or incidents, cases of forced or child labour, and significant worker grievances — the Contractor shall notify the Engineer and PIURR within 48 hours and submit a full report within five working days (ESMP, Section 8.3).

9.4.7. Costs

All costs associated with ESMP and CESMP implementation — including staffing, monitoring equipment, sampling, laboratory analysis, reporting, training, induction, PPE, community liaison, grievance management, spill response equipment, seasonal work restrictions, biodiversity protection measures, and site reinstatement — are the Contractor's responsibility and shall be priced within the construction contract. No additional payment will be made for ESHS compliance costs. Costs associated with PIURR-held instruments, including the RP, SEP, and ESIA, are PIURR's responsibility and are not included in the construction contract (ESMP, Section 8.10).

9.5. Summary

The table below summarises the key environmental, social, health and safety (ESHS) responsibilities of each principal party. Full responsibilities are set out in Sections 9.2–9.5. Cross-references to the ESMP and ESAP are provided in the final column.

Table 121: Summary of ESHS Implementation Responsibilities

Responsibility Area	Key Responsibilities	Ref.
PIURR — Implementing Agency		
Instruments & ESMS	Owns all project E&S instruments (ESIA, ESMP, SEP, RP, LMP); ensures currency and consistency; initiates updates and submits revised documents to EBRD as required. Establishes Project ESMS before mobilisation.	ESAP 1.1
ESAP Implementation	Develops and maintains ESAP implementation plan with measurable metrics and timelines for each action; notifies EBRD promptly of any at-risk items.	ESAP 1.1
Permitting & SEE	Holds SEE conclusion; ensures conditions incorporated into CESMP. Maintains permit tracker for all national approvals and coordinates with competent authorities.	ESMP §3.1
CESMP Approval	Provides written approval for all 16 CESMP sub-plans alongside the Engineer; CESMP-09 (Labour) additionally requires EBRD no-objection.	ESMP §8.2
Land Access & Resettlement	Confirms in writing that RP compensation is paid for each section before works commence. Monitors livelihood restoration outcomes until targets confirmed as met; results reported semi-annually to EBRD.	ESAP 5.1, 5.3
Net Gain Programme	Finalises and submits NGP to EBRD for approval before any works affect confirmed Critical Habitat.	ESAP 6.2
Stakeholder Engagement & GRM	Appoints dedicated CLO; leads quarterly consultations, women/vulnerable focus groups, and school road safety sessions. Overall GRM accountability; grievances acknowledged within 5 working days, resolved within 30 days; submits semi-annual SE log to EBRD.	ESAP 10.1, 10.2
Reporting	Engineer prepares semi-annual EMRs on behalf of PIURR; submitted to EBRD within 20 working days of period end. PIURR submits annual operational monitoring reports for first 5 operational years. Category 1 non-compliances notified to EBRD within 5 working days.	ESMP §7, §8.7
Independent Audit	Commissions independent third-party E&S compliance audit every two years; reports submitted to EBRD within 60 days.	ESAP 1.8
Engineer — CSC		



ESAP Support	Assists PIURR to develop ESAP implementation plan with metrics and timelines per action feeding into semi-annual EBRD reporting.	ESAP 1.1
CESMP Review	Reviews and approves CESMP and sub-plans within 10 working days; Contractor resubmits within 5 days of comments; approval required ≥ 30 days before physical works; Commencement Notice not issued until CESMP approved and EBRD no-objection confirmed.	ESMP §8.2
NCR System	Establishes formal NCR system covering all ESHS aspects; submitted to PIURR and EBRD in Inception Report subject to no-objection. NCRs categorised, tracked to closure; critical NCRs escalated immediately to PIURR and EBRD.	ESMP §8.8
Inspections & Stop-Work	Routine and unannounced inspections of all sites, camps, borrow areas, and access roads. Authority to issue immediate stop-work instructions binding on Contractor until lifted in writing.	ESMP §7
Technical Approvals	Approves geotechnical results before bridge foundation works; approves borrow area method statements; may specify additional mitigation in sensitive areas.	ESMP §6.2
Audits	Annual Labour Audits (first no later than main workforce mobilisation; format subject to EBRD no-objection ≥ 30 days before first audit). Road Safety Audit before completion. Resettlement Audit before close-out.	ESAP 2.9
Reporting & Meetings	Receives Contractor monthly reports by 5th of month; forwards to PIURR within 10 working days with independent assessment. Convenes monthly ESHS meetings. Prepares semi-annual EMRs on behalf of PIURR.	ESMP §7, §8.9
Staffing	Senior Environmental Expert/Team Leader; Environmental Monitoring Expert; Social/Gender Expert; OHS Specialist (continuous); Resettlement Specialist and Traffic/Road Safety Expert (periodic). The CSC ESHS Staffing Plan and Organisational Chart, demonstrating adequate resourcing to support delivery of the ESMP, is subject to EBRD no-objection.	ESMP §8.12
Contractor		
CESMP & Staffing	Submits CESMP within 7 days of Commencement Date; approval required ≥ 30 days before physical works. Full-time ESM and HSS; H&S Supervisors (1:50 workers); part-time Ecologist; Labour Officer; SCLO (Tajik/Russian). ESM and HSS have stop-work authority.	ESMP §8.2, §8.4
Implementation & Cascade	Implements all ESMP measures; cascades to all subcontractors regardless of employment status; each subcontractor appoints on-site safety representative; no child or forced labour at any tier. Obtains all Contractor-held permits before related works commence.	ESMP §8.1



Reporting & Incidents	Monthly ESHS reports to Engineer by 5th of each month. Serious incidents and chance finds notified within 24 hours; full report within 48 hours. Fatalities notified immediately; detailed report to lenders within 3 working days. Labour incidents (SEA/SH, strikes, forced/child labour) notified within 48 hours; full report within 5 working days.	ESMP §8.3
Costs	All ESMP/CESMP implementation costs priced within the construction contract; no additional payment for ESHS compliance. PIURR-held instrument costs (RP, SEP, ESIA) are not in the construction contract.	ESMP §8.10

10. Conclusions and Recommendations

10.1. Conclusions

The Project will deliver year-round reliable paved road access to approximately 6,000 corridor residents currently dependent on a deteriorated and seasonally impassable track. The operational phase represents a net positive outcome for communities, improving access to healthcare, education, and markets and materially enhancing emergency response capacity for upper valley settlements.

The ESIA concludes that the majority of adverse impacts will occur during construction, will be temporary and localised, and are manageable through the mitigation measures identified in this ESIA and its associated ESMP. Key construction-phase impacts requiring active management relate to in-river works and sedimentation, community road access disruption, land acquisition and irrigation infrastructure, and the presence of ecologically sensitive habitat and species along the Shurobdaryo corridor — including Critical Habitat triggered by two Critically Endangered wild pear species, which carries a Net Gain obligation under EBRD ESR6.

The operational road will generate modest residual impacts — principally diffuse surface runoff and increased access pressure on the Sari Khosor Nature Park — both of which are addressed through the monitoring programme set out in this ESIA.

With the mitigation and management measures identified in this ESIA implemented effectively, residual impacts are assessed as low to moderate across most receptors. The principal exception is the Critical Habitat triggered under EBRD ESR6 for two Critically Endangered wild pear species (*Pyrus tadshikistanica* and *P. korshinskyi*), confirmed along the corridor during the May 2026 survey. For these species the Project carries a Net Gain obligation, to be achieved through avoidance-led design and a Biodiversity Offset Programme; subject to delivery of that programme, no net loss of biodiversity value is anticipated at the corridor level. The Project is confirmed as Category A under the EBRD Environmental and Social Policy (2024).

10.2. Recommendations

The mitigation measures and monitoring requirements identified in this ESIA will be incorporated into the contract documents for the construction works, making all environmental and social obligations binding on the Contractor. The Contractor will prepare a site-specific Construction Environmental and Social Management Plan consistent with this ESIA, which will be approved before any works commence and monitored throughout construction.

Before works commence in each section, PIURR is required to confirm that land acquisition and resettlement compensation has been paid, that community water sources and irrigation access points have been audited, and that emergency air access arrangements for the upper corridor have been confirmed with the relevant authorities.

During construction, the avoidance-led design review and offset arrangements for the Critical Habitat-triggering wild pear species, the seasonal exclusion window for in-river works, pre-construction ecological surveys for Eurasian Otter and gravel-bank nesting birds, pre-works raptor nest checks (including the Egyptian and Cinereous Vulture nests at km 2–4), and spill prevention controls along the Shurobdaryo corridor are priority requirements that must be in place before works begin in each section.

Implementation will be overseen through the four-party framework of PIURR, Engineer, Contractor, and EBRD, with roles and responsibilities defined in the Implementation chapter of this ESIA.



Annex A – List of Culverts

Section 1.

№/№	PK	Name facilities	Expenditure m3/sec	Projected facilities				Existing facilities
				Qty. holes in the structure, pcs	Right angle crossed. with a route m	Diameter or hole facilities with a route m	Length projecting, facilities, m	Diameter or hole facilities, m
1	0+40	Monolithic gutter	cuv bypass	1	90	1,00x1,00	11	
	1+30		spillway					
2	3+56	Monolithic reinforced concrete flume	overflow	1	90	1,00x1,00	13	
3	5+55	reconstruction Monolithic reinforced concrete pipe	2,87	1	90	1,50x1,50	5+30	1,50x1,50
4	6+60	Round reinforced concrete pipe	bypass	1	90	1,00x1,00	14	
5	7+32	reconstruction monolithic reinforced concrete pipe	3,93	1	108	1,5x1,5	6+22	1,50x1,50
6	9+25	Round reinforced concrete pipe	1,76	1	277	1,50	12	
7	10+20	Round reinforced concrete pipe	0,175	1	90	1,00	25	
8	11+49	monolithic reinforced concrete pipe reconstruction	5,65	1	90	2,00x2,00	9+26	2,00x2,00
9	12+94	Round reinforced concrete pipe	0,20	1	90	1,00	18	
10	14+84	Round reinforced concrete pipe	5,26	1	90	2,00x2,00	24	
11	16+45	Round reinforced concrete pipe	2,54	1	90	1,50	14	
12	18+70	Round reinforced concrete pipe	3,98	1	90	1,50	20	
13	20+13	Monolithic reinforced concrete tray	0,439	1	90	1,00x1,00	13	
14	21+80	Round reinforced concrete pipe	2,99	1	90	1,50	13	
15	22+70	reconstruction Monolithic reinforced concrete pipe	2,9	1	90	1,50x1,50	43	1,50x1,50
16	26+80	Round reinforced concrete pipe	2,86	1	90	1,50	30	
17	29+45	reconstruction monolithic reinforced concrete pipe	Laliconi 21,3	1		3,00x2,50		
18	34+20	Round reinforced concrete pipe	bypass	1	90	1,00	12	
19	36+12	monolithic reinforced concrete pipe reconstruction	2,030	1	90	1,50x1,50	6+13,60	1,50x1,50
20	41+00	reconstruction of monolithic	9,490	1	90	2,00x2,00	5+18,66	

№/№	PK	Name facilities	Expenditure m3/sec	Projected facilities				Existing facilities
				Qty. holes in the structure, pcs	Right angle crossed. with a route m	Diameter or hole facilities with a route m	Length projecting, facilities, m	Diameter or hole facilities, m
		reinforced concrete pipe						
21	41+58	Round reinforced concrete pipe	3,024	1	90	1,50	14	
22	45+10	Round reinforced concrete pipe	0,725	1	90	1,00	18,00	
23	48+31	monolithic reinforced concrete pipe reconstruction	1 Dulamaidon 22,2	1	261	4,00x2,50	3,5+20,67+2,5	4,00x2,50
24	52+10	Round reinforced concrete pipe	0,412	1	90	1,00	13	
25	52+68	Round reinforced concrete pipe	0,557	1	90	1,00	13	
26	53+47	Round reinforced concrete pipe	2,970	1	90	1,50	13	
27	56+65	Round reinforced concrete pipe	1,140	1	90	1,00	16	
28	57+80	Round reinforced concrete pipe	1,190	1	90	1,00	13	
29	59+25	Round reinforced concrete pipe	2,210	1	90	1,50	14	
30	60+50	Round reinforced concrete pipe	0,422	1	90	1,00	13	
31	64+73	Prefabricated reinforced concrete pipe	4,38	1	90	1,5	17	
32	67+05	Round reinforced concrete pipe	3,18	1	90	1,00	12	
33	69+26	reconstruction monolithic reinforced concrete pipe	2 Dulamaidon 8,05	1	90	2,00x2,00	31,81+6	
34	71+20	Round reinforced concrete pipe	кюв bypass +1,98	1	90	1,50	14	
35	77+98	Prefabricated reinforced concrete pipe	13,09	1	90	3,00x2,50	14	
36	82+59	reconstruction monolithic reinforced concrete pipe	Shaabakht 18,94	1	90	4,00x2,50	2+25,72+2	
37	83+07	Round reinforced concrete pipe	bypass	1	90	1,00	15	
38	91+30	Prefabricated reinforced concrete pipe	14,11	1	90	3,00x2,50	26	
39	92+90	Round reinforced concrete pipe	bypass +1,13	1	90	1,50	12	
40	98+40	Prefabricated reinforced concrete pipe	3,94	1	90	1,50	23	
41	101+60	Round reinforced concrete pipe	bypass	1	90	1,00	12	
42	105+30	Round reinforced concrete pipe	14,27	1	251	3,00x2,50	15,00	
43	108+90	Round reinforced concrete pipe	bypass	1	90	1,00	15,00	
44	116+23	Prefabricated reinforced concrete pipe	18,96	1	254	3,00x2,50	17,00	
45	120+66	Prefabricated reinforced concrete pipe	20,06	1	66	3,00x2,50	30,00	

№/№	PK	Name facilities	Expenditure m3/sec	Projected facilities				Existing facilities
				Qty. holes in the structure, pcs	Right angle crossed. with a route m	Diameter or hole facilities with a route m	Length projecting, facilities, m	Diameter or hole facilities, m
46	137+37	Round reinforced concrete pipe	21	1	90	3,00x2,50	15,00	
47	154+80	Round reinforced concrete pipe	14,84	1	90	3,00x2,50	19,00	
48	159+77	Round reinforced concrete pipe	19,66	1	90	3,00x2,50	16,00	
49	171+70	Prefabricated reinforced concrete pipe	к-к Dashmandy 21,06	1	262	3,00x2,50	30,00	
50	174+70	Round reinforced concrete pipe	bypass	1	90	1,00	14	
51	177+48	Prefabricated reinforced concrete pipe	29,8	1	313	4,00x2,50	23	
52	179+97	Prefabricated iron pipe	2,01	1	90	1,5	17	
53	192+60	Round reinforced concrete pipe	2,74	1	90	1,50	17	
54	198+06	monolithic reinforced concrete pipe reconstruction	38,4	1	90	5,00x2,50	3+22,68+4	
55	206+68	reconstruction of monolithic reinforced concrete pipe	26,7	1	90	2,00x2,00	2,5+18,11+6,5	
56	215+66	Prefabricated reinforced concrete pipe	40,92	1	90	5,00x2,50	17	
57	216+11	Round reinforced concrete pipe	bypass	1	90	1,00	12	
58	220+50	Round reinforced concrete pipe	3,26	1	90	1,50	12	
59	224+12	Round reinforced concrete pipe	43,84	1	90	5,00x2,50	17	
60	233+58	Prefabricated reinforced concrete pipe	19	1	90	3,00x2,50	17	
61	246+93	Prefabricated reinforced concrete pipe	26,49	1	256	4,00x2,50	14	
62	256+17	Monolithic reinforced concrete pipe	44,68	1	259	5,00x2,50	23	
63	261+32	Round reinforced concrete pipe	bypass +1,13	1	90	1,50	16	
64	264+40	Round reinforced concrete pipe	2,55	1	239	1,50	16	
65	265+90	Round reinforced concrete pipe	cuv bypass/1,94	1	90	1,50	15	
66	271+24	Prefabricated reinforced concrete tray	bypass	1	90	1,00x1,00	12	
67	281+40	Prefabricated reinforced concrete tray	passage/can	1	90	1,00x1,00	12	
68	283+02	Round reinforced concrete pipe	ditch	1	90	1,00	18	
69	284+99	Round reinforced concrete pipe	15	1	248	3,00x2,50	14	
70	289+37	Prefabricated reinforced concrete tray	ditch	1	90	1,00x1,00	11	

Section 2.

№/№	PK	Name facilities	Expenditure m3/sec	Projected facilities			
				Qty. holes in the structure, pcs	Right angle crossed. off the track	Diameter or hole facilities m	Length projector, facilities m
1	300+60	Prefabricated reinforced concrete tray	cuv bypass	1	90	1,00x1,00	11
2	303+86	Prefabricated reinforced concrete pipe	16,35	1	240	3,00x2,50	13
3	309+83	Prefabricated reinforced concrete gutter	cuv bypass	1	90	1,00x1,00	14
4	310+20	Prefabricated reinforced concrete gutter	passage/can	1	90	1,00x1,00	14
5	312+12	Prefabricated reinforced concrete tray	bypass	1	90	1,00x1,00	17
6	316+40	Round reinforced concrete pipe	bypass	1	90	1,00	26
7	318+00	Prefabricated reinforced concrete tray	bypass cuv	1	296	1,00x1,00	15
8	321+30	Prefabricated reinforced concrete tray	cuv bypass	1	90	1,00x1,00	11
9	325+86	Round reinforced concrete pipe	1,89	1	289	1,5	18
10	326+42	Round reinforced concrete pipe	3,89	1	90	1,5	21
11	327+30	Round reinforced concrete pipe	cuv bypass	1	90	1,00	19
12	328+66	Round reinforced concrete pipe	3,73	1	90	1,5	13
13	330+00	Round reinforced concrete pipe	2,31	1	250	1,5	20
14	331+80	Round w.b pipe	2,45	1	284	1,5	15
15	333+43	Prefabricated reinforced concrete pipe	4,91	1	258	2,00x2,00	22
16	337+03	Round reinforced concrete pipe	3,59	1	90	1,5	17
17	339+35	Round reinforced concrete pipe	3,64	1	90	1,5	23
18	340+49	Round reinforced concrete pipe	3,22	1	90	1,5	14
19	341+46	Round reinforced concrete pipe	2,87	1	90	1,5	22
20	342+44	Round reinforced concrete pipe	bypass	1	90	1,0	22
21	349+78	Round reinforced concrete pipe	ditch	1	90	1,0	14
22	357+27	Round reinforced concrete pipe	ditch	1	90	1,0	16
23	361+32	Round reinforced concrete pipe	ditch	1	90	1,0	20
24	384+40	Round reinforced concrete pipe	3,4	1	90	1,5	18
25	386+74	Prefabricated reinforced concrete pipe	7,13	1	90	2,00x2,00	19
26	394+42	Prefabricated reinforced concrete pipe	16,37	1	98	3,00x2,50	24
27	395+40	Round reinforced concrete pipe	4,33	1	90	1,5	20
28	400+02	Prefabricated reinforced concrete pipe	10,61	1	296	2,00x2,00	18
29	409+26	Prefabricated reinforced concrete pipe	35,04	1	90	4,00x2,50	20
30	411+50	Prefabricated reinforced concrete tray	1,65	1	90	1,50	14
31	411+97	Prefabricated reinforced concrete tray	1,43	1	90	1,50	13

№/№	PK	Name facilities	Expenditure m3/sec	Projected facilities			
				Qty. holes in the structure, pcs	Right angle crossed. off the track	Diameter or hole facilities m	Length projector, facilities m
32	414+21	Prefabricated reinforced concrete pipe	7,8	1	90	2,00x2,00	17
33	419+74	Prefabricated reinforced concrete pipe	14,9	1	213	3,00x2,50	30
34	424+41	Round reinforced concrete pipe	4,68	1	306	1,5	17
35	426+74	Round reinforced concrete pipe	3,36	1	90	1,5	18
36	435+87	Round reinforced concrete pipe	ditch	1	301	1,5	20
37	438+40	Round reinforced concrete pipe	bypass	1	90	1,5	15
38	439+10	Round iron pipe	bypass	1	90	1,00	13
39	439+63	Round w.b pipe	1,75	1	-90	1,5	14
40	443+03	Round w.b pipe	1,9	1	-90	1,5	14
41	444+10	Round w.b pipe	ditch	1	90	1,00	16
42	446+36	Round reinforced concrete pipe	ditch	1	90	1,00	16
43	453+84	Prefabricated reinforced concrete pipe	15,17	1	247	3,00x2,50	22
44	465+52	Round reinforced concrete pipe	2,13	1	-90	1,5	24
45	467+38	Round reinforced concrete pipe	ditch	1	90	1,00	24
46	472+56	Prefabricated reinforced concrete pipe	7,5	1	229	2,00x2,00	24
47	481+18	Prefabricated reinforced concrete pipe	15,68	1	238	3,00x2,50	22
48	483+87	Prefabricated reinforced concrete pipe	20,53	1	90	3,00x2,50	24
49	508+56	Prefabricated reinforced concrete pipe	9,52	1	90	2,00x2,00	18
50	521+82	Round reinforced concrete pipe	bypass	1	90	1,00	21
51	532+25	Round reinforced concrete pipe	3,59	1	217	1,5	28

Baljuvon – Sari Khosor (BSK) Road Rehabilitation Project

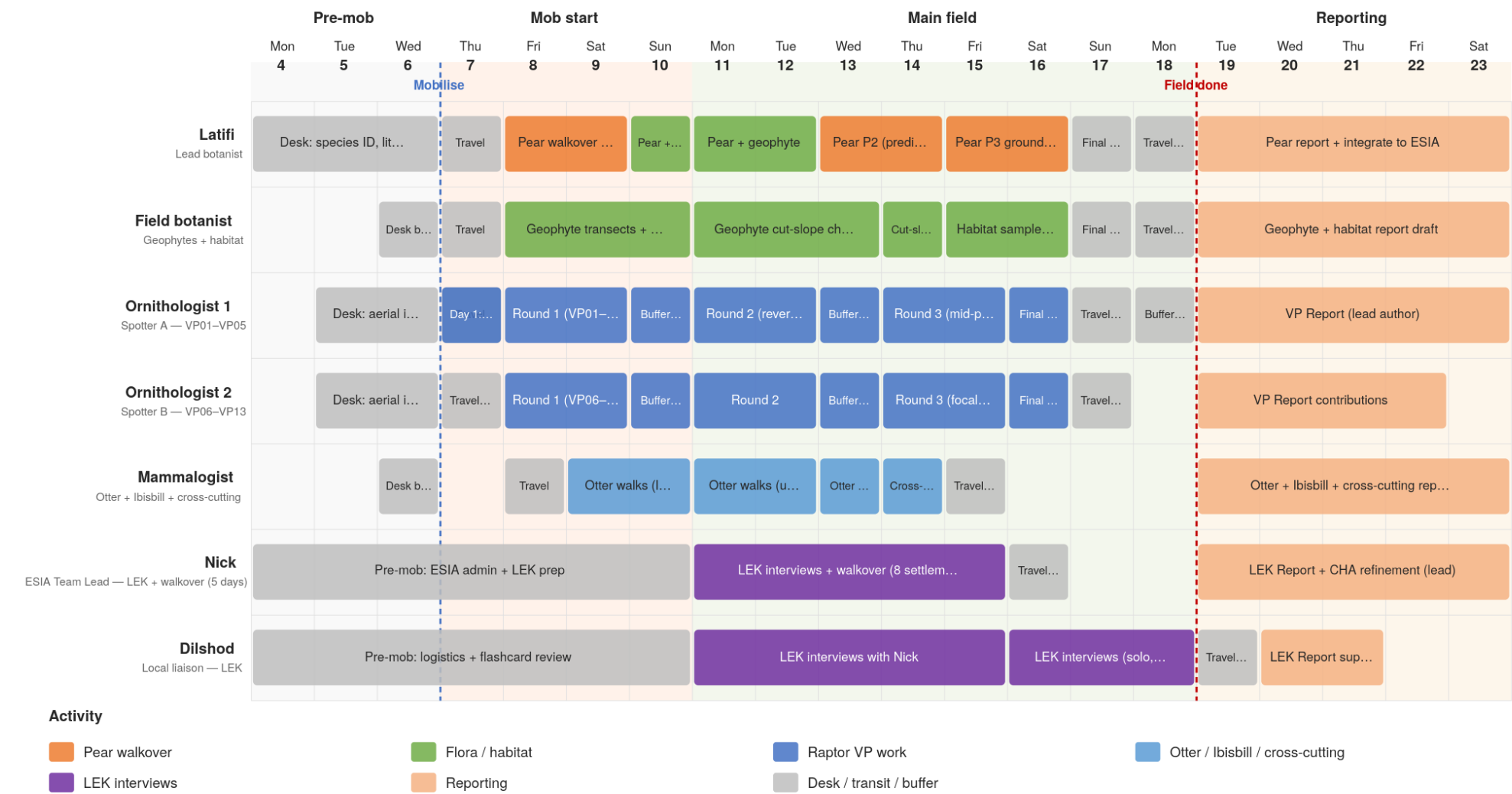
Tajikistan

Survey Outline

#	Brief	Part	Page
1	CR Pear Species (<i>Pyrus tadshikistanica</i> , <i>P. korshinskyi</i>)	Part A	4
2	Cliff-Nesting Raptors and Vultures (8 species)	Part B	5
3	Red Book Flora — Geophytes (<i>Tulipa</i> , <i>Eremurus</i> , <i>Iris/Juno</i> , <i>Allium</i>)	Part C, §C.2	7
4	Eurasian Otter (<i>Lutra lutra</i>)	Part C, §C.3	8
5	Ibisbill (<i>Ibidorhyncha struthersii</i>)	Part C, §C.4	9
6	Riparian Indicator Species and Habitat Assessment	Part C, §C.5	10
7	Cross-Cutting Fauna and Reptile Recording	Part C, §C.6	11
8	Local Ecological Knowledge & Specialist Consultations	Part C, §C.7	12

Specialist mobilisation schedule

Day-by-day plan for each specialist across pre-mobilisation, mobilisation, main field, and reporting phases. Bars are coloured by activity type. The dashed verticals mark mobilisation start (Thu 7 May) and field completion (Mon 18 May). Reflects the streamlined seven-person team and 13-VP raptor design.



CR Pear Species (*Pyrus tadshikistanica*, *P. korshinskyi*)
Part A

Three discrete activities:

- (i) desk study and structured specialist consultations to build the structured-evidence package;
- (ii) May field walkover to locate every pear tree (*Pyrus* sp.) in the corridor and apply precautionary 100 m no-go zones;
- (iii) September fruiting visit for definitive species identification and AZE assessment if Critically Endangered confirmed. Mamadsodekh's reported isolated trees at 500–600 m off-corridor in the upper area are now confirmed as outside the corridor, but require ground-truth.

Actions across the mobilisation

Phase	Action	Who	By end of phase
Pre-mob Mon 4 – Wed 6 May	Formal written record of Mamadsodekh consultation (date, credentials, structured Q&A, signed corridor map)	Latifi	Lead consultation record
	Ask Mamadsodekh for second-specialist recommendation; approach Institute of Botany TAS in parallel (HARD requirement for EBRD package)	Latifi / Project Manager	Second specialist secured
	Run literature review (IUCN, AZE, IBAT, GBIF, Eastwood 2009, Flora of Tajikistan)	Latifi	Lit review draft
	GIS team: build SRTM-based predictive habitat suitability map for both species	GIS support	Predictive map v1
Mob start Thu 7 – Sun 10 May	Mobilise to Baljuvon/Sari Khosor; begin Priority 1 walkover (alignment ± 50 m)	Latifi	Field log Days 1–4
	Continue with Priority 2 (50–250 m corridor) at chainages where predictive map shows high/moderate likelihood	Latifi	GPS waypoints, photos, measurements per tree
Main field Mon 11 – Mon 18 May	Complete Priority 3 ground-truthing of Mamadsodekh's 500–600 m off-corridor populations (at least one site)	Latifi	Field completion by Mon 18 May
Reporting Tue 19 – Sat 23 May	Finalise Pear Tree Field Survey Report; integrate into consolidated ESIA Biodiversity Survey Report for EBRD disclosure	Latifi / Project Manager	Final report by 31 May
	Confirm September visit dates and CEP permit status	PIURR / Project Manager	Sep visit booked

Cliff-Nesting Raptors and Vultures (8 species)
Part B

Vantage Point survey covering Egyptian, Bearded, and Cinereous Vultures; Saker and Barbary Falcons; Eastern Imperial and Golden Eagles; and Yellow-eyed Pigeon. Thirteen VPs (12 anchored to design-drawing-confirmed cut slopes and access roads, plus one supplementary at km 51 covering the AZE-trigger upper-gorge habitat). Two-hour watches, three rounds, parallel-section design with two ornithologists each handling one half of the corridor across all rounds. Total 78 observation hours combined across both spotters; 6 working days for VP rounds plus Day 1 ground-truth and 2 buffer days. See Raptor VP Field Plan and Field Forms Pack for operational detail; KMZ field map for navigation.

Actions across the mobilisation

Phase	Action	Who	By end of phase
Mob start Thu 7 – Sun 10 May	Day 1 (Thu 7 May): both ornithologists drive corridor end-to-end together; ground-truth and confirm all 13 VP positions; check sight lines	Ornithologist 1 + Ornithologist 2	VP siting confirmation
	Day 2–3 (Fri 8 – Sat 9): Round 1. Spotter A covers VP01–VP05 (lower corridor); Spotter B covers VP06–VP13 (upper corridor including AZE VP12)	Ornithologist 1 (Spotter A); Ornithologist 2 (Spotter B)	Round 1 datasheets (13 sessions)
Main field Mon 11 – Mon 18 May	Day 5–6: Round 2 (reverse pattern; afternoon watches flip morning timing for diurnal replication)	Two parallel teams	Round 2 datasheets
	Day 8–9: Round 3 (mid-pattern; pairings rotated; final occupancy test at any candidate active features)	Two parallel teams	Round 3 datasheets — completes 39 watch sessions by 18 May
	Cliff-feature inventory updated each evening; candidate features revisited across rounds for occupancy confirmation	Both ornithologists	Cliff-feature inventory
	Compile flight-line maps; identify haulage-sensitivity chainages (recurring crossings)	Ornithologist 1 (lead)	Flight-line analysis
Reporting Tue 19 – Sat 23 May	Finalise VP Survey Report (section-by-section, candidate features, occupancy, haulage analysis)	Ornithologist 1 (lead)	Final report by 23 May
	Populate BMP Sensitive Feature Register entries; brief Contractor pre-season survey scope	Ornithologist 1 / Project Manager	SFR + Contractor brief
	Update CHA species status (Confirmed where observed; Likely-not-detected with caveats where not)	Stephen / Ornithologist 1	CHA refinement input

Red Book Flora — Geophytes (Tulipa, Eremurus, Iris/Juno, Allium)

Part C, §C.2

Population-level inventory of early- to mid-flowering Red Book geophytes within the 250 m corridor, weighted to engineering-confirmed cut-slope chainages where the works will physically intersect undisturbed slope habitat. Two confirmed PBFs (*Tulipa praestans*, *T. anisophylla*) plus full target list. Mitigation framing favours seed banking and ex situ conservation over translocation (poor *Tulipa* translocation success rates). Survey design pairs with raptor VP work in using cut-slope chainages as the priority spatial structure.

Actions across the mobilisation

Phase	Action	Who	By end of phase
Pre-mob Mon 4 – Wed 6 May	Confirm cut-slope chainages with engineering team — drives both this survey and VP placement; HIGHEST PRIORITY pre-mob action	Project Manager / engineering	Cut-slope chainage list
Mob start Thu 7 – Sun 10 May	Mobilise alongside pear walkover; stratified transects within 250 m corridor (alignment, +50 m, +100 m offsets where access permits)	Latifi + Field botanist	Transects walked
	Enhanced effort at cut-slope chainages — complete walked coverage of slope above and below alignment at each flagged chainage	Field botanist	Cut-slope coverage
Main field Mon 11 – Mon 18 May	GPS + photo + count + identification confidence flag for every record; population polygons where >10 individuals	Field botanist	Geospatial dataset
	Complete sample coverage of rocky scrub habitats outside alignment-adjacent ground	Field botanist	Field completion by 18 May
	Document negative findings (transects walked, time, conditions)	Latifi	Effort log
	Identify receptor sites within corridor (similar habitat, outside works footprint) for any required translocation	Latifi	Receptor site map
Reporting Tue 19 – Sat 23 May	Finalise Red Book Flora Survey Report with GIS layer, cut-slope overlap analysis, ESIA impact framing	Latifi	Final report by 23 May
	Populate Sensitive Feature Register entries for each population within/close to works footprint	Latifi	SFR entries

Eurasian Otter (*Lutra lutra*)**Part C, §C.3**

Presence/absence walk along the Shurobdaryo riverbank, wound back from the original three-tier stratification per EBRD guidance. Operational management remains in the BMP (50 m holt buffer, December–June seasonal restriction, Contractor pre-construction holt re-check under C-PC-03). Focus: 10 bridge sites and 7 principal tributary confluences.

Actions across the mobilisation

Phase	Action	Who	By end of phase
Mob start Thu 7 – Sun 10 May	Travel + start riverbank walks at lower corridor bridge sites	Mammalogist	Lower-corridor coverage start
Main field Mon 11 – Mon 18 May	Walk Shurobdaryo riverbank, ± 200 m at each bridge and at each tributary confluence	Mammalogist	Walk completion
	Cover identified intact riparian scrub reaches	Mammalogist	Sign records
	Record spraints, footprints, resting platforms, holt features; GPS + photo per record	Mammalogist	Records dataset
	Field completion by 18 May (light-touch walk fits well within window)	Mammalogist	Field complete
	Flag any holt features within 50 m of bridges as precautionary entries for SFR / Contractor C-PC-03	Mammalogist	Holt-feature inventory
Reporting Tue 19 – Sat 23 May	Finalise Otter Survey Findings Note; confirm BMP architecture remains operationally adequate	Mammalogist	Final note by 23 May

Ibisbill (*Ibidorhyncha struthersii*)**Part C, §C.4**

Two components: (i) sample-based gravel-bar check at upper corridor (km 35–53) only, opportunistic during otter walks; (ii) structured settlement interviews retained substantially as planned, integrated with the wider LEK programme. LEK flashcard deck includes Ibisbill (Card 14) paired with Common Sandpiper (Card 15) as validation control.

Actions across the mobilisation

Phase	Action	Who	By end of phase
Mob start Thu 7 – Sun 10 May	Conduct settlement interviews using LEK flashcard deck (Cards 14 + 15)	Dilshod + Nick	Interview records
Main field Mon 11 – Mon 18 May	During otter walks at km 35–53, opportunistically inspect gravel bars >50 m length	Mammalogist (during km 35–53 walks)	Gravel-bar records
	Field completion by 18 May	Field team	Field complete
Reporting Tue 19 – Sat 23 May	Finalise Ibisbill Findings Note with recommendation on BMP Ibisbill protocol downgrade (likely outcome: downgrade to backstop within Contractor pre-construction obligation)	Mammalogist / Project Manager	Final note by 23 May

Riparian Indicator Species and Habitat Assessment
Part C, §C.5

Two components: (i) tugai indicator-species check during otter walks in lower corridor (km 0–20) — confirms CHA Criterion 4 conclusion that classic tugai is absent, replacing the elevation argument with a morphology + indicator-species argument; (ii) sample-reach habitat description across the corridor to support EBRD-requested CHA habitat-mapping refinement.

Actions across the mobilisation

Phase	Action	Who	By end of phase
Mob start Thu 7 – Sun 10 May	During otter walks in km 0–20, presence/absence record for each tugai indicator species	Latifi / Field botanist (during otter-walk overlap)	Indicator records
	Photographs of riparian community at each sample reach; dominant species recorded	Field botanist	Photographic record
Main field Mon 11 – Mon 18 May	At each sample reach, record overstorey/understorey, canopy cover %, ground cover, slope, aspect, disturbance evidence, habitat-type classification	Field botanist	Reach records
	Field completion by 18 May	Field botanist	Field complete
Reporting Tue 19 – Sat 23 May	Finalise Note; provide CHA narrative update (replace elevation argument with morphology + indicator-species)	Latifi / Stephen	Final note by 23 May
	Update BMP glossary entry on tugai (remove elevation argument)	Stephen	BMP glossary update

Cross-Cutting Fauna and Reptile Recording
Part C, §C.6

Opportunistic structured recording carried by all field specialists alongside their primary-target datasheets — no dedicated days. Covers mammals (incl. wide-ranging PBF species), reptiles (with European Glass Lizard priority), amphibians, non-VP-target birds, and conspicuous invertebrates. Active reptile season makes this useful for ESIA-stage baseline.

Actions across the mobilisation

Phase	Action	Who	By end of phase
Mob start Thu 7 – Sun 10 May	All specialists record incidental observations during primary-target transects	All field specialists	Incidental records
Main field Mon 11 – Mon 18 May	Particular attention to rocky scrub, dry stone walls, talus slopes for Glass Lizard	All field specialists; Latifi for Glass Lizard ID	Reptile records
	Cliff-nesting raptor records flagged immediately for VP team integration via inReach	All field specialists	Flagged records
	Continue incidental recording during write-up week	Specialists still in field	Continued records
	Confirmed Glass Lizard locations enter Sensitive Feature Register for Contractor pre-construction reptile survey scope	Mammalogist	SFR entries
Reporting Tue 19 – Sat 23 May	Finalise Cross-Cutting Fauna Report (mammals, reptiles incl. Glass Lizard, amphibians, general avifauna, invertebrates)	Mammalogist	Final report by 23 May

Local Ecological Knowledge & Specialist Consultations
Part C, §C.7

Eight settlements; structured 30–45 min interview with 16-card flashcard deck (5 priority CHA + 2 engagement controls + 2 known-absence controls + 4 raptor + 3 other fauna). Supplemented by structured specialist consultations (Institute of Zoology TAS; Sari Khosor Nature Park / SISPT). Nick is in field 5 days only (Mon 11 – Fri 15 May); Dilshod stays through 18 May for solo interviews.

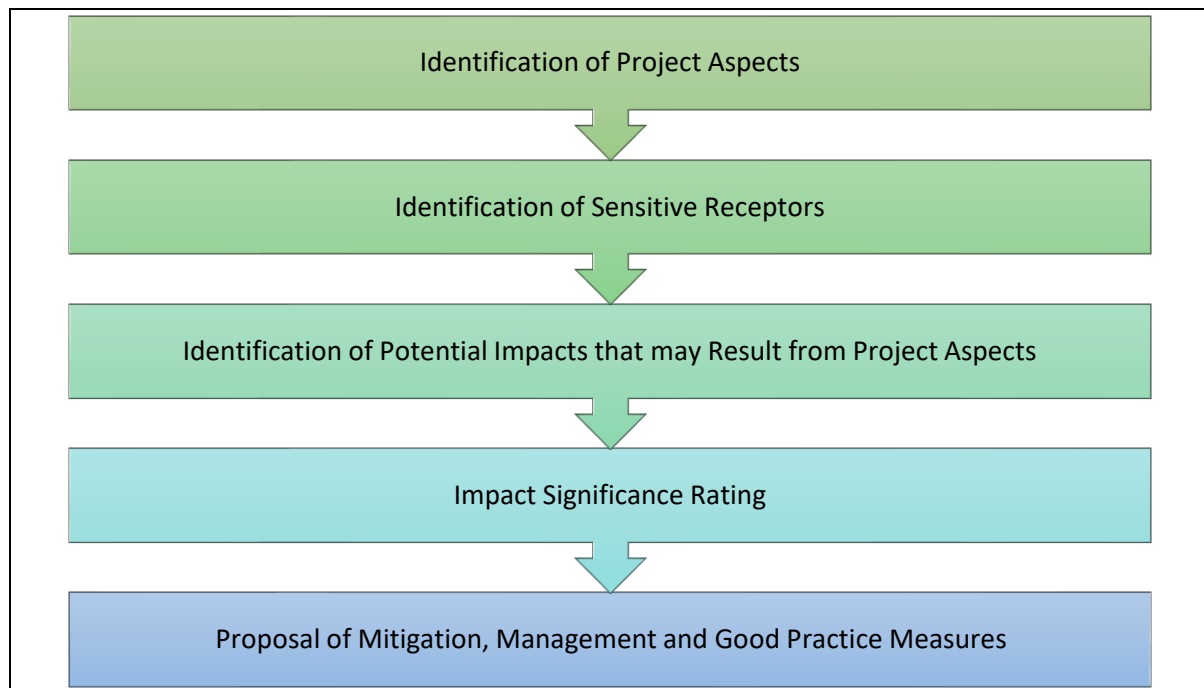
Actions across the mobilisation

Phase	Action	Who	By end of phase
Mob start Thu 7 – Sun 10 May	Conduct interviews at all 8 settlements: Baljuvon, Khosadeh, Shahidon, Toydara, Sari Khosor cluster, Dashtaro, mid-corridor selection, upper-corridor selection	Dilshod + Nick	8 settlement interview records
Main field Mon 11 – Mon 18 May	2–4 respondents per settlement (herders, fishers, farmers, woodcutters, elders); attention to age and gender diversity	Dilshod	Diverse respondent base
	Pass any nest-site reports for cliff-nesting raptors to VP team in real time via inReach	Nick	Live VP team feed
	Nick departs Fri 15 May. Dilshod completes any outstanding settlement interviews solo.	Dilshod	Field complete by 18 May
Reporting Tue 19 – Sat 23 May	Finalise LEK and Specialist Consultation Report	Nick (ESIA Team Lead)	Final report by 23 May
	Produce CHA species screening recommendations (which species to screen out, downgrade, or retain)	Stephen / Nick	CHA refinement input — one of the principal CHA simplification deliverables

Annex C – ESIA Methodology

This ESIA follows a set format during the impact assessment process. As shown in the following flow chart and described further below.

Impact Assessment Process



Project Aspects

Firstly, the main environmental aspects of the Project are noted. An environmental and social aspect is any activity of the Project that interacts with the environment (environment is taken to include physical, biological, and human (social) environment). E.g., an aspect of the Project that may impact upon air quality will be the movement of vehicles on unpaved roads through rural settlements.

Identification of Sensitive Receptors

Once the main aspects of the Project have been identified any sensitive receptors within the Project area of influence are noted. Examples of sensitive receptors include residents, rivers, groundwater, birds, etc. Identification of receptors is a key part of the impact assessment process as without a receptor there will be no impact. For example, if a road generates significant noise but there are no sensitive receptors who can hear the noise, then there will be no noise impact.

Identification of Significant Environmental and Social Aspects

Thirdly, the potential impacts of the identified aspects are outlined and how they could impact upon the identified receptors, in the case above, this could be the movement of a construction vehicle creating dust on an unpaved road which impacts upon local villagers.

The significance of an impact is determined based on the product of the consequence of the impact and the probability of its occurrence. The consequence of an impact, in turn, is a function primarily of three impact characteristics:

- magnitude



- spatial scale
- timeframe

Magnitude is determined from quantitative or qualitative evaluation of several criteria including:

- Sensitivity of existing or reasonably foreseeable future receptors.
- Importance value of existing or reasonably foreseeable future receptors, described using the following:
 - i. inclusion in government policy.
 - ii. level of public concern.
 - iii. number of receptors affected.
 - iv. intrinsic or perceived value placed on the receiving environment by stakeholders.
 - v. economic value to stakeholders.
- Severity or degree of change to the receptor due to impact, measured qualitatively or quantitatively, and through comparison with relevant thresholds:
 - i. legal thresholds—established by law or regulation
 - ii. functional thresholds if exceeded, the impacts will disrupt the functioning of an ecosystem sufficiently to destroy resources important to the nation or biosphere irreversibly and/or irretrievably
 - iii. normative thresholds – established by social norms, usually at the local or regional level and often tied to social or economic concerns
 - iv. preference thresholds—preferences for individuals, groups, or organizations only, as distinct from society at large
 - v. reputational thresholds—the level of risk a company or organization is willing to take when approaching or exceeding the above thresholds

Spatial scale is another impact characteristic affecting impact consequence. The spatial scale of impacts can range from localized (confined to the proposed Project Site) to extensive (national or international extent). They also may vary depending on the component being considered.

The impact timeframe is the third principal impact characteristic defining impact consequence and relates to either its duration or its frequency (when the impact is intermittent). Impact duration can range from relatively short (less than four years) to long (beyond the life of the Project). Frequency ranges from high (more than 10 times a year) to low (less than once a year). These timeframes will need to be established for each Project based on its specific characteristics and those of the surrounding environment.

Once the impact consequence is described based on the above impact characteristics, the probability of impact occurrence is factored in to derive the overall impact significance. The probability relates to the likelihood of the impact occurring, not the probability that the source of



the impact occurs. For example, a continuous Project activity may have an unlikely probability of impact if there are no receptors within the area influenced by that activity. The characteristics are outlined in the table below.

Characteristics Used to Describe Impact

Characteristic	Sub-components	Terms Used to Describe the Impact
Type		Positive (a benefit), negative (a cost) or neutral
Nature		Biophysical, social, cultural, health or economic Direct, indirect or cumulative or induced
Phase of the Project		Pre-construction, construction and operation.
Magnitude	Sensitivity of Receptor	High, medium or low capacity to accommodate change High, medium or low conservation importance Vulnerable or threatened Rare, common, unique, endemic
	Importance or value of receptor	High, medium or low concern to some or all stakeholders High, medium or low value to some or all stakeholders (for example, for cultural beliefs) Locally, nationally or internationally important Protected by legislation or policy
	Severity or degree of change to the receptor	Gravity or seriousness of the change to the environment Intensity, influence, power or strength of the change Never, occasionally or always exceeds relevant thresholds
Spatial Scale	Area affected by impact – boundaries at local and regional extents will be different for biophysical and social impacts	Area or Volume covered Distribution Local, regional, transboundary or global
Timeframe	Length of time over which an environmental impact occurs or frequency of impact when intermittent	Short term or long term Intermittent (what frequency) or continuous Temporary or permanent Immediate effect (impact experienced immediately after causative project aspect) or delayed effect (effect of the impact is delayed for a period following the causative project aspect)



Characteristic	Sub-components	Terms Used to Describe the Impact
Probability – likelihood or chance an impact will occur		<p>Definite (impact will occur with high likelihood of probability)</p> <p>Possible (impact may occur but could be influenced by either natural or project related factors)</p> <p>Unlikely (impact unlikely unless specific natural or Project related circumstances occur)</p>

Impact Significance Rating

The impact significance rating process serves two purposes: firstly, it helps to highlight the critical impacts requiring consideration in the approval process; secondly, it serves to show the primary impact characteristics, as defined above, used to evaluate impact significance. The impact significance rating system is presented in table below and described as follows:

- Part A: Define impact consequence using the three primary impact characteristics of magnitude, spatial scale and duration.
- Part B: Use the matrix to determine a rating for impact consequence based on the definitions identified in Part A; and
- Part C: Use the matrix to determine the impact significance rating, which is a function of the impact consequence rating (from Part B) and the probability of occurrence.

Using the matrix, the significance of each described impact is rated.

Method for Rating Significance

PART A: DEFINING CONSEQUENCE IN TERMS OF MAGNITUDE, DURATION AND SPATIAL SCALE			
Definition		Criteria	
MAGNITUDE		Negative	Positive
	Major	<p>Large number of receptors affected</p> <p>Receptors highly sensitive and/or are of conservation importance</p> <p>Substantial deterioration, nuisance or harm to receptors expected</p> <p>Relevant thresholds often exceeded</p> <p>Significant public concern expressed during stakeholder consultation</p> <p>Receiving environment has an inherent value to stakeholders</p>	<p>Large number of receptors affected</p> <p>Receptors highly amenable to positive change</p> <p>Receptors likely to experience a big improvement in their situation</p> <p>Relevant positive thresholds often exceeded</p>
	Moderate	<p>Some receptors affected</p> <p>Receptors slightly sensitive and/or of moderate conservation importance</p>	<p>Some receptors affected</p> <p>Receptors likely to experience some improvement in their situation</p>

		Measurable deterioration, nuisance or harm to receptors Relevant thresholds occasionally exceeded Limited public concern expressed during stakeholder consultation Limited value attached to the environment	Relevant positive thresholds occasionally exceeded	
	Minor	No or limited receptors within the zone of impact Receptors not sensitive to change Minor deterioration, nuisance or harm to receptors Change not measurable or relevant thresholds never exceeded Stakeholders have not expressed concerns regarding the receiving environment	No or limited receptors affected Receptors not sensitive to change Minor or no improvement in current situation Change not measurable Relevant positive thresholds never exceeded No stakeholder comment expected	
TIMEFRAME		Duration of Continuous Aspects	Frequency of Intermittent Aspects	
	Short term / low frequency	Less than 4 years from onset of impact	Occurs less than once a year	
	Medium term / medium frequency	More than 4 years from onset of impact up to end of life of project (approximately 30 years)	Occurs less than 10 times a year but more than once a year	
	Long term / high frequency	Impact is experienced during and beyond the life of the project (greater than 30 years)	Occurs more than 10 times a year	
SPATIAL SCALE		Biophysical	Socio-economic	
	Small	Within the defined 'Project area'	Within the defined 'Project area'	
	Intermediate	Within the district in which is the facilities are located	Within the municipality in which the activity occurs	
	Extensive	Beyond the district in which the facilities are located	Beyond the municipality in which the activity occurs	
PART B: DETERMINING CONSEQUENCE RATING				
MAGNITUDE	TIMEFRAME	SPATIAL SCALE		
		Small	Intermediate	Extensive
Minor	Short term / low frequency	Low	Low	Medium
	Medium term / medium frequency	Low	Low	Medium
	Long term / high frequency	Medium	Medium	Medium
Moderate	Short term / low frequency	Low	Medium	Medium
	Medium term / medium frequency	Medium	Medium	High
	Long term / high frequency	Medium	High	High
Major	Short term / low frequency	Medium	Medium	High
	Medium term / medium frequency	Medium	Medium	High
	Long term / high frequency	High	High	High
PART C: DETERMINING SIGNIFICANCE RATING				

		CONSEQUENCE			
		Negligible	Low	Medium	High
PROBABILITY (of exposure to impacts)	Definite	Not Significant	Low	Medium	High
	Possible	Not Significant	Low	Medium	High
	Unlikely	Not Significant	Low	Low	Medium
	Negligible	Not Significant	Not Significant	Not Significant	Not Significant

Cumulative, Transboundary / Global Impacts & Induced Impacts

The ESIA also identifies and assesses the significance of any cumulative and transboundary / global impacts.

The cumulative impact of the project is the incremental impact of the project when added to impacts from other relevant past, present and reasonably foreseeable developments as well as unplanned but predictable activities enabled by the project that may occur later or at a different location. Cumulative impacts can result from individually minor but collectively significant activities taking place over a period.

Transboundary and global risks and impacts, include impacts from effluents and emissions, increased use or contamination of international waterways, emissions of short- and long-lived climate pollutants.

WB ESS1 Guidance Note (GN23.5 (Footnote 21)) notes that “cumulative impacts must be considered if they are reasonably foreseeable. Impacts that are merely possible, or that are considered speculative, are not reasonably foreseeable. Only those effects that are likely, or foreseeable, or reasonably foreseeable need to be discussed. The terms likely and foreseeable, as applied to impacts, are properly interpreted as meaning that the impact is sufficiently likely to occur so that a person of ordinary good judgment would take it into account in reaching a decision. Borrowers are not expected to assess or mitigate induced impacts due to their unknown, speculative, uncertain, or remote nature.”

Mitigation, Management and Good Practice Measures

Wherever the Project is likely to result in unacceptable impact on the environment and social conditions, mitigation measures are proposed (over and above the inherent design measures included in the Project description). In addition, good practice measures may be proposed however these are unlikely to change the impact significance. In the case of positive impacts, management measures are suggested to optimize the benefits to be gained.

The following mitigation hierarchy will be utilized in selecting practical mitigation measures for unacceptable impacts as follows (in order of preference):

- Avoid the impact wherever possible by removing the cause(s).
- Reduce the impact as far as possible by limiting the cause(s).
- Ameliorate the impact by protecting the receptor from the cause(s) of the impact.

Providing compensatory measures to offset the impact, particularly where an impact is of high significance and none of the above are appropriate, e.g., for impacts to critical habitat.



Residual Impacts

Once mitigation measures are declared and committed to, the next step in the impact assessment process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation measures.



Annex D – Critical Habitat Assessment



Annex E – Correspondence with CEP



COMMITTEE FOR ENVIRONMENTAL PROTECTION UNDER THE
GOVERNMENT OF THE REPUBLIC OF TAJIKISTAN

* * *

STATE ESTABLISHMENT “SPECIALLY PROTECTED NATURAL
AREAS”

734025, Dushanbe city, 62 Dustii khalqko Street, tel.: (+992 37) 222-14-67, fax: (+992 37) 222-07-97, E-mail:
oopt_tj@mail.ru

№ 202 dated “13” 12 2024 year
To _____ dated “ ” 2024 year

State Unitary
Enterprise “Design
Institute for Transport
Infrastructure”

The Establishment has considered your letter of inquiry dated 10 December 2024, No.333 on the verification of potential impact from the implementation of the “Baljuvon-Sari Khosor Road Rehabilitation Project” on the natural area of the “Sari Khosor” Natural Park, and hereby brings to your notice that this park is located within the administrative territory of Baljuvon district, taking place at 5 km distance far from the corridor of Baljuvon-Sari Khosor Road to be build. The “Sari Khosor” Natural Park is one of the objects referred to the specially protected natural areas, and it is under a special regime of protection.

It should be noted that in general during the implementation of the project, certain components of the environment such as atmospheric air, land/soil, and flora experience impact in different forms, like physical impact, noise, vibration. However, considering that the “Sari Khosor” Natural Park is located at more than 5 km distance far, the probability of impacts on this natural area is rated as negligible.

At the same time, we are informing you, that within the territory of Dashtaro village, which is located in the vicinity of the Baljuvon-Sari Khosor Road to be build, there is a Bukhara Deer breeding farm with an area of 3 hectares in running, which is considered as one of the remote objects under the “Sari Khosor” Natural Park’s superintendence.

In view of all above stated and the requirements of acting legislation in the respect of specially protected natural areas, we proposed to take into account the probability of potential impacts on the mentioned breeding farm, while planning the construction and rehabilitation of the subject road, and provide for the necessary action measures.

Chairperson

[signed]

Kh.Shamsiddinzoda



Annex F – Biodiversity Survey Data (to date)

Part A — Summary of Survey Activities and Findings

This Part A is written as a stand-alone summary suitable for direct extraction into the ESIA. It presents the survey programme, methodology, consolidated findings and significance. Full survey-level detail, complete species lists and point-by-point records supporting every statement below are held in Part B (Detailed Appendix), which is intended for inclusion as a whole in the CHA annexes.

A1. Overview

The biodiversity baseline for the Baljuvon–Sari Khosor (BSK) Road Project was established in two phases. A desk-based assessment with an early-season field walkover (Latifi, March 2026) compiled the regional baseline and identified the Priority Biodiversity Features (PBFs) requiring active-season field verification. A targeted field mobilisation in May 2026 then confirmed those features at peak phenology. All survey work was delivered in accordance with EBRD Performance Requirement 6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources).

The May 2026 mobilisation comprised four field work packages delivered along the road corridor between the district centre of Baljuvon and the jamoat of Sari Khosor / Sharshar Waterfall: a targeted botanical survey (Muhammadsoleh, 8–10 May); a parallel geobotanical and carnivore mission (Khanjarov and Ergashev, 9–10 May); a combined bird and Eurasian Otter survey (Khursand, Nugzar and Talbonov, 8–10 May), with a Stage 2 repeat for occupancy confirmation (Garibmamadov, Talbonov et al., 16–18 May); and a raptor monitoring and community consultation expedition (Ergashev, 9–10 May).

The headline outcomes are: (i) confirmation of 22 individuals of two Critically Endangered wild pear species (*Pyrus tadshikistanica* and *Pyrus korshinskyi*) along the alignment, together with two wild apple (*Malus sieversii*) sites and a population of Anzur onion; (ii) confirmation of six Egyptian Vulture nests (one independently corroborated) and one Cinereous Vulture nest within or close to the corridor, including nests at km 2–4 inside the works zone; (iii) confirmation of Eurasian Otter presence near Shoidon, approximately 300 m downstream of an active bridge construction site, with negative results in the lower corridor; and (iv) Local Ecological Knowledge interviews with six corridor residents that corroborated the otter record and confirmed community awareness of Red Book species.

Collectively the results refine the project biodiversity baseline and support upgrades to the corridor presence status of several PBFs under the Critical Habitat Assessment (CHA, Rev01, April 2026). None of the findings change the overall Critical Habitat conclusion of the CHA, but several require strengthening of the mitigation framework in the Biodiversity Management Plan (BMP).

A2. Survey Programme — Who, What and When

The table below summarises each survey package, the personnel involved, the dates and coverage, the methods applied and the principal output. Full personnel lists, institutional affiliations and survey-level method statements are given in Part B.

Table A1. Survey programme summary.

Survey package	Dates	Personnel	Coverage / where	Methods	Key output
Desk study + early-season walkover	Desk 2026; field 23–24 Mar 2026	Alikhon Latifi	Wider Sari Khosor area incl. Natural Park	Literature review; route-based field survey; signs; LEK; photo-documentation	Regional baseline: 1,500+ plants, 147 endemics, 31 Red Book fauna; carrion-attended scavenger guild; geophyte

Survey package	Dates	Personnel	Coverage / where	Methods	Key output
					confirmation deferred to peak season
Botanical survey	8–10 May 2026	Muhammadsoleh Oev	Full corridor, Baljuvon → Sari Khosor; 27 transect sites	Transect method; 100 m transects with 10 m buffer each side; GPS; habitat description; rare-tree measurements	22 <i>Pyrus</i> individuals; 2 <i>Malus sieversii</i> sites; <i>Allium suworowii</i> population; 11 tugai fragments; full species lists
Geobotanical + carnivore mission	9–10 May 2026	Andam Khanjarov (geobotanist); S.T. Ergashev (carnivore specialist)	Corridor survey section	Route-based botanical and faunal survey; signs; LEK	Woody flora (25 spp., 5 protected); 12 Red Book herbaceous spp. for the area; rare plants sparse on the road verge
Bird & Otter survey — Stage 1	8–10 May 2026	Khursand; Nugzar; Talbonov Kh.M.	14 points over 54 km (946–1,422 m a.s.l.); Shurobdaryo banksides	Route-and-point counts, 2 h per point; optics; bankside otter sign survey; LEK	6 tabulated Egyptian Vulture nests; scavenger guild counts; otter signs near Shoidon; reptile/mammal incidentals
Bird survey — Stage 2 (repeat)	16–18 May 2026	Garibmamadov G.D.; Talbonov Kh.M.; Safarmamadova G.; Shodibekov U. (IZP NAST)	Same 14 points, two field groups	Repeat route-and-point counts at Stage 1 waypoints	Re-confirmation of nest occupancy; consistent raptor records
Raptor monitoring + consultations	9–10 May 2026	S.T. Ergashev	14 points over 56 km; villages Bogi Zogon ↔ Doshmandi	Vantage-point raptor observation; 6 structured questionnaire interviews	1 Egyptian Vulture + 1 Cinereous Vulture nest at km 2–4 (works zone); LEK on Red Book fauna and otter

A3. Methodology and Coverage

Botanical coverage used a transect method along the full alignment, with 27 survey sites each comprising a 100 m transect and a 10 m buffer on both sides, targeting Red Data Book trees (particularly *Pyrus tadshikistanica*, *Pyrus korshinskyi* and *Malus sieversii*), rare *Allium* and wild tulips. Identification followed the Flora of Tajikistan with cross-reference to the Red Data Book of the Republic of Tajikistan (2024). For every rare tree the team recorded coordinates, elevation, approximate age, height, distance from the road and reproductive state, and described habitat condition and disturbance. Tugai fragments were mapped and characterised by rapid vegetation assessment.



Ornithological coverage applied the route-and-point method used in mountain surveys: movement along a fixed route with two-hour observation watches at 14 fixed points, recording coordinates, elevation, time, weather, temperature, species, counts, flight direction, distance, flight altitude and nest presence, using 8×42 / 10×42 binoculars and a 20–60× spotting scope. The bird survey was run twice — Stage 1 (8–10 May) and a Stage 2 repeat (16–18 May) for occupancy confirmation. The otter component used standard bankside sign survey along the Shurobdaryo (tracks, spraints, slides, prints, feeding remains) with LEK interviews. Survey work in the upper river on 10 May was curtailed by heavy rainfall and a rapid rise in water levels.

Raptor monitoring (Ergashev) used elevated vantage points selected for line-of-sight into the major cliff faces. The community consultation used a structured questionnaire with photograph and brief-description recall aids, administered to six residents between Bogi Zogon and Doshmandi villages.

A4. Consolidated Findings

Red Book flora

The botanical survey confirmed 22 individuals of the genus *Pyrus*: 6 *Pyrus tadshikistanica* (km 11, 15, 29, 34 and 48) and 16 *Pyrus korshinskyi* (km 16, 37, 43 and 47), mostly as isolated trees or small scattered groups on dry slopes and foothill habitats close to the corridor, several mature and showing flowering, fruiting or natural regeneration. Both species are listed as Critically Endangered (IUCN B2ab(iii,v)) and in the national Red Data Book. Two separate sites of wild apple *Malus sieversii* (Endangered; CITES) were recorded at km 9 and km 12. A population of Anzur onion was located between km 33 and km 34. The survey also mapped 11 tugai vegetation fragments dominated by *Elaeagnus angustifolia* and *Tamarix ramosissima* with *Salix excelsa* in wetter reaches, and documented a full corridor tree list (25 woody species, five protected) and 56 herbaceous taxa.

Cliff-nesting raptors

The Stage 1 bird survey tabulated six Egyptian Vulture nests — three at 38.54289 N / 69.87254 E (Point 350), two at 38.55266 N / 69.88575 E (Point 351), and one at 38.33192 N / 69.68716 E (Point 347, approximately km 2, within the works zone) — all re-confirmed occupied in the Stage 2 repeat. The Ergashev expedition independently confirmed one Egyptian Vulture nest and one Cinereous Vulture nest at km 2–4 within the planned works footprint; the Egyptian Vulture nest is the same receptor as the Point 347 / km 2 nest, while the Cinereous Vulture nest is an additional, separate receptor. The defensible corridor total is therefore six confirmed Egyptian Vulture nests (one independently corroborated) plus one confirmed Cinereous Vulture nest. Scavenger-guild abundance comprised 12 Egyptian Vulture individuals (four points), 13 Griffon Vulture individuals (three points) and 2 Cinereous Vulture individuals (Point 348, approximately km 14), together with a single Barbary Falcon (*Falco pelegrinoides*) at the Point 351 cliff face and a Blue Whistling Thrush (*Myophonus caeruleus*) near km 14 — both confirmed PBFs.

Eurasian Otter and other mammals

Otter signs were confirmed at one location, in the upper Shurobdaryo near Shoidon village (38.52055 N / 69.82906 E, 1,304 m a.s.l.), approximately 300 m downstream of an active bridge construction site (approximately km 30), where two rivers merge, the water deepens and large rocky outcrops rise on both banks — habitat consistent with otter holting and foraging. Stone Marten (*Martes foina*) and Stoat (*Mustela erminea*) were sighted at the same location. Results were negative through the lower corridor, where the river broadens and shallows, consistent with the morphological argument underpinning the CHA Criterion 4 conclusion. An incidental record of European Glass Lizard

(*Pseudopus apodus*, nationally Endangered) at 38.35418 N / 69.69446 E represents the first active-season corridor record for this species.

Local Ecological Knowledge

Six structured interviews were conducted between Bogi Zogon and Doshmandi villages, with respondents comprising a game warden of the Baljuvon forestry enterprise, a teacher from secondary school No. 28 (Dashtikilko), two Doshmandi residents and two herders from Vakhsh and Yavan districts. Respondents showed generally good fauna knowledge, strongest for frequently encountered species, and several recognised Egyptian and Cinereous Vultures from the photograph deck. Fishermen near Shoidon confirmed otter presence in the upper river, including otters taking fish from catches — directly corroborating the field record — while lower-corridor respondents reported that otters are not seen there, also consistent with the field result.

A5. Consolidated Records Table

Key Red Book and PBF records confirmed during the 2026 surveys are consolidated below for inclusion in the project Sensitive Feature Register. Full coordinates, photographic vouchers and habitat descriptions are held in the individual surveyors' reports reproduced in Part B.

Table A2. Consolidated key biodiversity records, BSK corridor, 2026.

Species	Status (Nat / IUCN)	Records (2026)	Chainage / location	ESIA / CHA implication
<i>Pyrus tadshikistanica</i>	CR / CR	6 individuals	km 11, 15, 29, 34, 48	Upgrade from possible to confirmed PBF; corridor-wide micro-realignment review
<i>Pyrus korshinskyi</i>	CR / CR	16 individuals	km 16, 37, 43, 47	Upgrade from possible to confirmed PBF; micro-realignment review
<i>Malus sieversii</i>	EN / — ; CITES	2 separate sites	km 9, km 12	Wild apple sites added to Sensitive Feature Register
Anzur onion (<i>Allium suworowii</i> / <i>A. stipitatum</i>)	RDB / —	1 population	km 33–34 / km 25 (see note)	Species ID and chainage to be reconciled; footprint relationship to be confirmed
<i>Neophron percnopterus</i> — nests	EN / EN	6 confirmed (re-confirmed Stage 2)	3 at Pt 350; 2 at Pt 351; 1 at Pt 347 (km 2)	Confirmed PBF; 250 m no-works buffer per active nest, 1 Mar–30 Sep (BMP §6.3)
<i>Neophron percnopterus</i> — individuals	EN / EN	12 individuals at 4 points	Corridor-wide	Confirms corridor breeding population; informs cumulative impact assessment
<i>Aegypius monachus</i> (Cinereous Vulture)	VU / NT	1 active nest; 2 individuals	Nest km 2–4; individuals Pt 348 (~km 14)	First confirmed corridor breeding record; site-specific mitigation at km 2–4
<i>Gyps fulvus</i> (Griffon Vulture)	— / LC	13 individuals at 3 points	Pts 345, 348, 349	Not a PBF; cumulative scavenger-community record
<i>Falco pelegrinoides</i> (Barbary Falcon)	EN / — ; CITES I	1 individual (both stages)	Pt 351 cliff face	Confirmed PBF; cliff-face occupancy to be verified at Stage 3

Species	Status (Nat / IUCN)	Records (2026)	Chainage / location	ESIA / CHA implication
<i>Myiophonus caeruleus</i> (Blue Whistling Thrush)	VU / —	1 individual	~km 14	Confirmed PBF; riparian / gorge specialist
<i>Lutra lutra</i> (Eurasian Otter)	EN / NT; CITES I	Signs at 1 location; LEK	Shoidon, ~300 m below bridge (38.52055, 69.82906)	Confirmed PBF; pre-construction holt survey required before further works (BMP §7)
<i>Pseudopus apodus</i> (Glass Lizard)	EN / —	1 individual	38.35418, 69.69446 (~km 4)	First active-season corridor record; supports BMP Annex 8 reptile scoping
<i>Martes foina</i> / <i>Mustela erminea</i>	— / LC	Sightings	Shoidon reach	Incidental records; supplementary fauna baseline

Part B — Detailed Survey Appendix

This Part B reproduces, in full, the survey-level detail underpinning the Part A summary: the Latifi desk study and March 2026 walkover, the May 2026 botanical and geobotanical surveys with complete species lists and coordinate-level records, the two-stage bird survey with point-by-point records, the otter survey, and the raptor monitoring and community consultation. It is intended for inclusion as a whole within the CHA annexes. A data-reconciliation note at the end (Section B7) records the discrepancies between source reports and the basis on which they have been resolved in Part A.

B1. Previous Work — Latifi Desk Study and March 2026 Walkover

The primary species-level desk resource is the Desk-Based Biodiversity Assessment prepared by Alikhon Latifi (Dushanbe, 2026), prepared in accordance with EBRD Performance Requirement 6. It covers the wider Sari Khosor area — a larger footprint than the established EAAA, including the Sari Khosor Natural Park — and establishes the regional baseline against which the corridor field results are assessed. From the perspective of physical-geographical zoning, the Sari Khosor area belongs to the south-western natural province of Tajikistan, bounded by the Gissar Range to the north, the Hazratishoh Range to the east, the Babatag Range to the west, and the Pyanj and Amu rivers to the south. The area is divided into eastern and western parts by the Shurobdaryo River, and is drained by the Shurobdaryo (originating near the Archatuq Pass at approximately 2,600 m and running more than 70 km to its confluence with the Obi Mazor). The climate is moderately continental, with mean annual precipitation of 767 mm.

B1.1 Flora baseline

The flora includes 107 species and subspecies of algae and more than 1,500 species of flowering plants. The dominant families are:

- Asteraceae — 122 species
- Fabaceae — 100 species
- Poaceae — 83 species
- Lamiaceae — 42 species
- Rosaceae — 39 species
- Liliaceae and Apiaceae — 33 species each

A total of 147 endemic plant species have been recorded in the Sari Khosor area, together with two Tertiary relict species of ancient origin — *Ostrowskia magnifica* and *Petilium eduardii*. Following the Ovchinnikov classification (1957–1981), vegetation in Tajikistan is divided into 20 types, of which 12 occur within the Sari Khosor area. These are summarised below with characteristic species and elevation ranges.

Table B1. Vegetation types of the Sari Khosor area (Latifi, 2026).

Vegetation type	Elevation (m a.s.l.)	Characteristic species
Broadleaf forests	—	<i>Juglans regia</i> , <i>Acer turkestanicum</i> , <i>Platanus orientalis</i> , <i>Malus sieversii</i> ; shrubs <i>Cotoneaster</i> spp., <i>Rosa canina</i> , <i>Berberis</i> spp., <i>Lonicera</i> spp.
Mesophilic deciduous shrub communities	800–2,800	<i>Rosa</i> spp., <i>Aflautunia ulmifolia</i> , <i>Exochorda alberti</i>
Poplar forests	800–3,000	<i>Populus bachofenii</i> , <i>P. tadshikistanica</i> , <i>P. konjilaliana</i> , <i>Fraxinus sogdiana</i> , <i>Hippophae rhamnoides</i> , <i>Salix</i> spp.
Tugai forests	500–1,600	<i>Elaeagnus angustifolia</i> , <i>Tamarix leptostachya</i> , <i>T. ramosissima</i> , <i>Hippophae rhamnoides</i>

Vegetation type	Elevation (m a.s.l.)	Characteristic species
Sparse woodlands (shiblyak)	800–1,600	<i>Pistacia vera</i> , <i>Amygdalus bucharica</i> , <i>Celtis caucasica</i> , <i>Cercis griffithii</i> , <i>Crataegus</i> spp.
Juniper forests	1,200–3,000	<i>Juniperus seravshanica</i> , often with <i>Acer turkestanicum</i> and <i>Populus tadshikistanica</i>
Herbaceous communities	800–2,000	<i>Origanum tyttanthum</i> , <i>Hypericum perforatum</i> , <i>Dracocephalum</i> spp., <i>Ziziphora pamiroalaica</i>
Cushion plant communities	1,000–4,000	<i>Acantholimon</i> and <i>Onobrychis</i> species
Semi-savannas	800–1,400	<i>Agrostis</i> , <i>Elytrigia</i> , <i>Roegneria</i> , <i>Polygonum coriarium</i>
Meadow vegetation	2,400–3,000	<i>Alopecurus</i> , <i>Agrostis</i> , <i>Elytrigia</i> , <i>Ligularia</i> spp.

Within the Sari Khosor area, 20 plant species listed in the Red Data Book of the Republic of Tajikistan (2024) have been identified, spanning the genera *Tulipa*, *Eremurus*, *Juno*, *Iris* and *Allium*. These occur in highly limited habitats; the main causes of decline are land development, livestock grazing and collection of medicinal, ornamental and edible plants.

B1.2 Fauna baseline

According to available literature, the fauna of the Sari Khosor area includes more than 2,000 insect species, 4 fish species, 24 reptile species, 84 bird species and 23 mammal species. A total of 31 animal species listed in the Red Data Book of the Republic of Tajikistan have been recorded. The Red Data Book fauna are listed below by group.

Table B2. Red Data Book fauna recorded for the Sari Khosor area (Latifi, 2026).

Group	Species (status)
Insects (10 spp.)	<i>Coenagrion scitulum</i> (VU); <i>Libelloides macaronius</i> (VU); <i>Dorcus sewertzowi</i> (EN); <i>Mallosiola regina</i> (VU); <i>Geotrupes banghaasi</i> (VU); <i>Papilio machaon</i> (VU); <i>Driopa mnemosyne</i> (VU); <i>Polyommatus avinovi</i> (EN); <i>Acosmeryx naga hissarica</i> (EN); <i>Hyles apocyni</i> (EN)
Fish (1 sp.)	Turkestan barbel (<i>Barbus capito conocephalus</i> , VU)
Reptiles (2 spp.)	European legless lizard (<i>Pseudopus apodus</i> , EN); Central Asian Levant viper (<i>Macrovipera lebetina turanica</i> , VU)
Birds (10 spp.)	Himalayan griffon (<i>Gyps himalayensis</i> , VU); Bearded vulture (<i>Gypaetus barbatus</i> , EN); Egyptian vulture (<i>Neophron percnopterus</i> , EN); Golden eagle (<i>Aquila chrysaetos</i> , VU); Saker falcon (<i>Falco cherrug coatsi</i> , EN); Barbary falcon (<i>Falco pelegrinoides</i> , EN); Blue whistling thrush (<i>Myophonus caeruleus</i> , VU); White-capped redstart (<i>Chaimarrornis leucocephala</i> , VU); Streaked laughingthrush (<i>Garrulax lineatus</i> , VU); Asian paradise flycatcher (<i>Terpsiphone paradisi leucogaster</i> , VU)
Mammals (7 spp.)	Indian crested porcupine (<i>Hystrix indica</i> , VU); Forest dormouse (<i>Dryomys nitedula</i> , VU); Tien Shan brown bear (<i>Ursus arctos isabellinus</i> , EN); Eurasian otter (<i>Lutra lutra</i> , EN); Eurasian lynx (<i>Lynx lynx isabellinus</i> , EN); Snow leopard (<i>Panthera uncia</i> , EN); Bukhara urial (<i>Ovis vignei bochariensis</i> , CR)

The ichthyofauna of the Shurob River comprises four species: Samarkand scraper (*Capoeta capoeta heratensis*, dominant), Common marinka (*Schizothorax intermedius*), Turkestan catfish (*Cluposternum reticulatum*) and Tibetan stone loach (*Nemacheilus stoliczkai*). Two amphibians occur — Green toad (*Bufo viridis*) and Marsh frog (*Pelophylax ridibundus*). The avifauna of 84 species comprises 9 resident, 12 migratory, 60 passage and breeding, and 3 vagrant species, associated with mountain rivers and floodplains, rocky habitats and forest. The 23 mammal species belong to six orders (Carnivora, Artiodactyla, Chiroptera, Lagomorpha, Rodentia and Eulipotyphla) and include

Snow Leopard, Siberian Ibex, Brown Bear, Eurasian Lynx, Eurasian Otter, Grey Wolf, Red Fox, Eurasian Badger and Stone Marten.

B1.3 March 2026 field walkover

Floristic and faunal surveys were conducted on 23–24 March 2026 along the road construction section, using route-based survey, visual observation and identification of animal signs, identification of key habitats, assessment of anthropogenic disturbance, and photo-documentation and geo-referencing, supplemented by indirect methods (tracks, droppings, vocalisations) and consultations with residents and environmental authorities. The objective was to assess the species composition of vertebrates, evaluate population and habitat status, and identify rare, endemic and protected species within the project's potential zone of influence. The report explicitly noted that the March timing fell early in the vegetation and reptile activity seasons, that many geophyte taxa had not entered active growth or flowering, and that results should be treated as preliminary pending targeted surveys at peak phenology. The May 2026 mobilisation was structured to close precisely these gaps.

Walkover records by group were as follows:

- Amphibians — Green toad (*Bufo viridis*) near water bodies and moist habitats.
- Reptiles — Lehmann's agama (*Laudakia lehmanni*) on open rocky substrates; Pannonian snake-eyed skink (*Ablepharus pannonicus*) in sparse vegetation on loose warm soil.
- Birds — at least eight families recorded. A single carrion-attended group of raptors comprised Griffon vulture (7), Egyptian vulture (2), Cinereous vulture (2) and Black kite (12), indicating a feeding resource within the corridor. Other records: Eurasian magpie, Carrion crow (4 encounters), Masked wagtail, White-throated dipper (2), Common myna (groups of 3–7), Common blackbird, Blue whistling thrush (1), Common chaffinch (7 females) and Eastern rock nuthatch (by call). Four Red Data Book birds were confirmed: Griffon, Egyptian and Cinereous Vultures and Blue Whistling Thrush.
- Mammals — Eastern mole vole (signs), Turkestan rat, Red fox (1), and Wild boar (reported via interview).

Carry-forward from Latifi

The March walkover established the scavenger guild and four Red Book birds as present, but could not confirm geophytes or the full reptile assemblage owing to early-season timing. The European Glass Lizard, Eurasian Otter, the wild pears and the Anzur onion were all carried forward as features requiring active-season field confirmation — which the May 2026 programme then provided.

B2. Botanical Survey (Muhammadsoleh, 8–10 May 2026)

Report prepared by Muhammadsoleh Oev, dated 25 May 2026. A field expedition was conducted from 8 to 10 May 2026 to carry out a preliminary botanical and environmental assessment of the territory planned for the Baljuvon–Sari Khosor road corridor, focusing on rare, endemic and protected plant species and important vegetation communities.

B2.1 Methodology

A field-based transect survey method was used. A total of 27 survey sites were established along different sections of the road, each consisting of a 100 m transect with a 10 m buffer zone on both sides, covering dry rocky slopes, foothill vegetation, river valleys, shrublands and tugai fragments. Special attention was given to rare wild fruit trees (*Pyrus tadshikistanica*, *Pyrus korshinskyi*, *Malus sieversii*) and rare herbaceous plants (wild tulips, rare *Allium*). For every recorded rare tree,

coordinates and elevation (handheld GPS), number of individuals, approximate age category, estimated height, distance from the road, and presence of flowers and fruits were documented, alongside habitat condition (slope exposure, terrain, moisture, associated vegetation, signs of disturbance). Tugai fragments were mapped and described by rapid vegetation assessment. Identification followed the Flora of Tajikistan with cross-reference to the Red Data Book (2024).

B2.2 Results — rare *Pyrus* species

In total, 22 individuals of *Pyrus* were recorded — 6 *Pyrus tadshikistanica* and 16 *Pyrus korshinskyi* — mostly as isolated individuals or small scattered groups on dry slopes and foothill habitats close to the corridor. *Pyrus tadshikistanica* was recorded at km 11, 15, 29, 34 and 48, several being mature trees with visible flowering or fruiting; *Pyrus korshinskyi* was recorded at km 16, 37, 43 and 47, in several locations showing signs of natural regeneration. Coordinate-level records are given below.

Table B3. Recorded individuals of rare *Pyrus* species along the BSK road corridor.

Species	Location	No. of individuals	Coordinates
<i>Pyrus tadshikistanica</i>	Horma	1	38.401077, 69.697581
<i>Pyrus tadshikistanica</i>	Near Surkhsang	2	38.253680, 69.425269
<i>Pyrus tadshikistanica</i>	Shahidon	1	38.512670, 69.814210
<i>Pyrus tadshikistanica</i>	Chilton	1 old tree	38.536216, 69.859340
<i>Pyrus tadshikistanica</i>	Near Mullokoni	1	38.624486, 69.959800
<i>Pyrus korshinskyi</i>	Surkhsang	10	38.434150, 69.720203
<i>Pyrus korshinskyi</i>	Dashti Toro	4	38.546183, 69.879825
<i>Pyrus korshinskyi</i>	Near the village	1	38.590267, 69.927714
<i>Pyrus korshinskyi</i>	Pogla	1	38.621001, 69.956338

B2.3 Results — other rare species and tugai

Two separate sites of wild apple *Malus sieversii* were recorded at km 9 and km 12, both with mature individuals in natural habitats. A population of Anzur onion (*Allium suworowii*) was documented between km 33 and km 34 on open rocky slopes; wild tulips were observed at several suitable spring habitats. Tugai vegetation fragments were recorded between km 5–6, 14–15, 16–17, 21–22, 24–25, 28–30, 34–35, 36–37, 40–42, 49–51 and 52–53 (11 fragments), dominated by *Elaeagnus angustifolia* and *Tamarix ramosissima*, with *Salix excelsa* in wetter reaches; most were degraded by grazing, wood-cutting and disturbance.

B2.4 Recorded tree species (Table B4)

All recorded woody species are listed below (25 species; five protected and listed in the IUCN Red List / Red Data Book of the Republic of Tajikistan: the two *Pyrus*, *Malus sieversii* and *Amygdalus bucharica* among them).

Table B4. Recorded tree and woody shrub species along the corridor.

No.	Tajik name	English name	Scientific name
1	Муруд	Tajik pear	<i>Pyrus tadshikistanica</i> Zaprjagaeva
2	Шакинг	Korzhinsky pear	<i>Pyrus korshinskyi</i> Litv.
3	Себи чангалӣ	Sievers apple	<i>Malus sieversii</i> (Ledeb.) M.Roem.
4	Бодоми талхак	Bukharan almond	<i>Amygdalus bucharica</i> Korsh.
5	Чормағз	Common walnut	<i>Juglans regia</i> L.
6	Туғ	Caucasian hackberry	<i>Celtis caucasica</i> Willd.
7	Шулаш (арғувон)	Griffith's redbud	<i>Cercis griffithii</i> Boiss.
8	Дӯлона	Pontic hawthorn	<i>Crataegus pontica</i> C.Koch

No.	Tajik name	English name	Scientific name
9	Дӯлонаҳор	Turkestan hawthorn	<i>Crataegus turkestanica</i> Pojark.
10	Заранг	Regel's maple	<i>Acer regelii</i> Pax
11	Фарк	Turkestan maple	<i>Acer turkestanicum</i> Pax
12	Олуча	Sogdian cherry-plum	<i>Prunus sogdiana</i> Vass.
13	Маҳлаб	Mahaleb cherry	<i>Padellus mahaleb</i> (L.) Vass.
14	Бушол	Korolkow's honeysuckle	<i>Lonicera korolkowii</i>
15	Ирғай	Coin-leaved cotoneaster	<i>Cotoneaster nummularioides</i> Pojark.
16	Хуч	Dog rose	<i>Rosa canina</i> L.
17	Гулхор	Fedchenko's rose	<i>Rosa fedtschenkoana</i> Regel
18	Говкусирак	Paulsen's bladder-senna	<i>Colutea paulsenii</i> Freyn & Sint.
19	Зирк	Diverse-cluster barberry	<i>Berberis heterobotrys</i> E.L. Wolf
20	Арчаи зарафшонӣ	Zeravshan juniper	<i>Juniperus seravschanica</i> Kom.
21	Сафедор	White poplar	<i>Populus alba</i> L.
22	Санҷид	Russian olive	<i>Elaeagnus angustifolia</i> L.
23	Бед	Tall willow	<i>Salix excelsa</i> S.G. Gmel.
24	Каин	Large-flowered calophaca	<i>Calophaca grandiflora</i> Regel
25	Сиёҳдарахт	Long-leaved buckthorn	<i>Rhamnus dolichophylla</i> Gontsch.

A total of 56 herbaceous and shrub species were additionally recorded in the survey transects (full list retained in the surveyor's technical report and the Khanjarov mission report, Section B3.2). The botanical survey concluded that the 22 *Pyrus* individuals do not represent the final and complete number present, owing to terrain, dense vegetation and limited survey time, and recommended that all identified *Pyrus* individuals near the construction corridor be clearly marked prior to works, with monitoring during and after construction.

B3. Geobotanical and Carnivore Mission (Khanjarov and Ergashev, 9–10 May 2026)

Report by Andam Khanjarov, geobotanist, who travelled to Baljuvon District on 9–10 May 2026 together with carnivore (predator) specialist S.T. Ergashev to survey the proposed road area for rare and endemic plant species and to identify local fauna, including carnivorous mammals. The mission characterises the woody and herbaceous flora of the district and the Red Data Book herbaceous species, complementing the corridor-focused Muhammadsoleh transect survey.

B3.1 Woody flora

The mission recorded 25 woody plant species within the district, five of which are listed in the IUCN Red List and the Red Data Book of the Republic of Tajikistan. The woody species list is identical in composition to Table B4 above. The mission noted that, directly along the Baljuvon–Sari Khosor route, rare species are extremely sparse: only Anzur onion (Persian shallot, *Allium stipitatum*) was recorded, at approximately km 25, with no other rare plants observed immediately on the road verge.

B3.2 Red Data Book herbaceous species

Twelve herbaceous species recorded in the area are listed in the Red Data Book of the Republic of Tajikistan.

Table B5. Red Data Book herbaceous species recorded for the area (Khanjarov, 2026).

No.	Scientific name	English name
1	<i>Allium stipitatum</i>	Persian shallot
2	<i>Allium trautvetterianum</i>	Trautvetter's onion
3	<i>Allium rosenbachianum</i>	Rosenbach's onion
4	<i>Bunium persicum</i> (Boiss.) B. Fedtsch.	Black caraway (zira)

No.	Scientific name	English name
5	<i>Juno nicolai</i>	Nicolai's iris
6	<i>Crocus korolkowii</i> Regel ex Maw	Korolkow's crocus
7	<i>Iris darwasica</i> Regel	Darvaz iris
8	<i>Iris hoogiana</i> Dykes	Hoog's iris
9	<i>Fritillaria eduardii</i> Regel	Eduard's fritillary
10	<i>Tulipa praestans</i> Th. Hoog	Tulipa praestans
11	<i>Tulipa tubergeniana</i> Th. Hoog	Tubergen's tulip
12	<i>Anemone bucharica</i> (Regel) Fin. & Gagnep.	Bukharan anemone

The mission concluded that the Vakhsh Range is a region with a high concentration of rare, endemic and relict plant species; the woody flora comprises 25 species including five protected taxa; and the herbaceous flora is highly diverse, with 12 Red Data Book species recorded, confirming the ecological significance of the region.

B4. Bird and Eurasian Otter Survey — Stage 1 (Khursand, Nugzar and Talbonov, 8–10 May 2026)

From 8 to 10 May 2026, a bird survey was carried out along the road from the district centre of Baljuvon to the Sharshar Waterfall in the Sari Khosor Gorge, a total route length of 54 km. Fourteen observation points were established and surveyed for scavenging birds, primarily the Egyptian Vulture, with two hours of observation at each point. In parallel, a mammal survey focused on the Eurasian Otter was conducted along the banks of the Sari Khosor (Shurobdaryo) River. Parallel Russian and English versions of this report were prepared (Talbonov; Khursand and Nugzar) and are treated as a single piece of work.

B4.1 Observation points

The eight principal raptor observation points and their coordinates were:

Point	Coordinates	Elevation (m a.s.l.)
345	38.32458 N, 069.68871 E	946
347	38.33192 N, 069.68716 E	988
348	38.41119 N, 069.70129 E	1,090
349	38.52947 N, 069.85406 E	1,338
350	38.54289 N, 069.87254 E	1,362
351	38.55266 N, 069.88575 E	1,384
352	38.57781 N, 069.91264 E	1,422
359	38.44232 N, 069.73442 E	1,180

B4.2 Recorded raptors and nests

The recorded raptor species, individual counts and nest records are reproduced below.

Table B6. Recorded raptor species and nests (Stage 1).

No.	Species / record	Count	Dir. (°)	Dist. (m)	Alt. (m)	Coordinates
1	Cinereous Vulture (<i>Aegypius monachus</i>)	2	180	1,000	2,000	38.41119 N, 069.70129 E
2	Griffon Vulture (<i>Gyps fulvus</i>)	9	285	2,000	1,000	38.32458 N, 069.68871 E
3	Griffon Vulture (<i>Gyps fulvus</i>)	2	90	1,000	2,000	38.41119 N, 069.70129 E
4	Griffon Vulture (<i>Gyps fulvus</i>)	2	315	3,000	2,000	38.52947 N, 069.85406 E
5	Egyptian Vulture (<i>Neophron percnopterus</i>)	4	315	40	300	38.54289 N, 069.87254 E

No.	Species / record	Count	Dir. (°)	Dist. (m)	Alt. (m)	Coordinates
6	Egyptian Vulture (Neophron percnopterus)	1	—	50	100	38.57781 N, 069.91264 E
7	Egyptian Vulture (Neophron percnopterus)	2	285	2,000	1,000	38.32458 N, 069.68871 E
8	Egyptian Vulture (Neophron percnopterus)	4	170	300	400	38.32458 N, 069.68871 E
9	Egyptian Vulture (Neophron percnopterus)	1	75	40	0	38.54289 N, 069.87254 E
10	Egyptian Vulture nest	1	275	—	100	38.54289 N, 069.87254 E
11	Egyptian Vulture nest	1	0	—	110	38.54289 N, 069.87254 E
12	Egyptian Vulture nest	1	15	—	300	38.54289 N, 069.87254 E
13	Egyptian Vulture nest	1	245	—	200	38.33192 N, 069.68716 E
14	Egyptian Vulture nest	1	304	—	100	38.55266 N, 069.88575 E
15	Egyptian Vulture nest	1	304	—	100	38.55266 N, 069.88575 E

This gives six tabulated Egyptian Vulture nests: three at Point 350 (38.54289 N / 69.87254 E), two at Point 351 (38.55266 N / 69.88575 E) and one at Point 347 (38.33192 N / 69.68716 E, approximately km 2, within the works zone).

B4.3 Eurasian Otter survey — daily results

The mammal expedition (8–10 May 2026) targeted aquatic mammals, in particular the Eurasian Otter, by surveying the banks of the Sari Khosor River for signs of activity (tracks, spraints and other traces).

8 May 2026:

- 38.33805, 69.68967 (963 m) — only tracks of Red Fox (*Vulpes vulpes*) detected.
- 38.35418, 69.69446 (971 m) — European Glass Lizard / Sheltopusik (*Pseudopus apodus*) observed.
- 38.41136, 69.70124 (1,085 m) — nothing detected.

9 May 2026:

- Near Shoidon village (38.52862, 69.82906; 1,373 m) — a bridge is under construction; approximately 300 m downstream, where two rivers merge, the water deepens and large rocky outcrops rise on both banks. At 38.52055, 69.82906 (1,304 m), otter tracks were found, and a Stone Marten (*Martes foina*) and a Stoat (*Mustela erminea*) were also sighted.
- 38.5453, 69.77348 (1,366 m) — 4 agama lizards observed.
- 38.48111, 69.77348 (1,159 m) — nothing detected owing to high current velocity.

In the lower part of the gorge the river spreads broadly, giving largely unfavourable conditions for otters.

10 May 2026:

- Work in the upper river was hampered by rainy weather and a sharp rise in water levels, making further surveys impossible.

Interviews with local residents indicated that otters are not observed in the lower river, while near Shoidon local fishermen reported instances of an otter attempting to take fish from their catches.

B5. Bird Survey — Detailed Point Records (Stage 1 and Stage 2)

A more detailed field report records the full species composition at each point across both survey stages. Stage 1 (8–10 May 2026) covered four points on 8 May, five on 9 May and five on 10 May. Stage 2 (16–18 May 2026) was a repeat survey by a four-person team from the Institute of Zoology

and Parasitology of the National Academy of Sciences of Tajikistan (IZP NAST): Garibmamadov G.D. (Senior Research Fellow, Cand. Biol. Sci.), Talbonov Kh.M. (Senior Research Fellow, Cand. Biol. Sci.), Safarmamadova Gavkhar (PhD candidate) and Shodibekov Umed (Doctoral candidate). For Stage 2 the team divided into two groups — Group 1 (Talbonov, Shodibekov) surveyed Points 1–8; Group 2 (Garibmamadov, Safarmamadova) surveyed Points 9–14.

B5.1 Stage 1 — 8 May 2026

Point 1 — 38.32458 N, 069.68871 E; 946 m; km 1.5; 11:00–14:00; clear, +27 °C.

No.	Species (English)	Latin name	Count	Dir. (°)	Dist. (m)	Alt. (m)
1	Griffon Vulture	<i>Gyps fulvus</i>	9	285	2000	1000
2	Egyptian Vulture	<i>Neophron percnopterus</i>	2	285	2000	1000
3	Pallid Harrier	<i>Circus macrourus</i>	2	-	-	-
4	Red-rumped Swallow	<i>Cecropis daurica</i>	5	-	-	-
5	European Roller	<i>Coracias garrulus</i>	3	-	-	-
6	Common Buzzard	<i>Buteo buteo</i>	1	-	-	-
7	Carrion Crow	<i>Corvus corone</i>	1	-	-	-
8	Eurasian Magpie	<i>Pica pica</i>	2	-	-	-
9	House Sparrow	<i>Passer domesticus</i>	10	-	-	-

Point 2 — 38.37446 N, 069.69367 E; 980 m; km 8; 14:30–16:30; clear, +31 °C. One bird recorded: Carrion Crow (*Corvus corone*), 1.

Point 3 — 38.33192 N, 069.68716 E; 988 m; km 2; 16:30 onwards; clear, +30 °C. Egyptian Vulture nest observed.

No.	Species (English)	Latin name	Count	Dir. (°)	Dist. (m)	Alt. (m)
1	Egyptian Vulture nest	<i>Neophron percnopterus</i>	1	245	300	500
2	Egyptian Vulture	<i>Neophron percnopterus</i>	4	-	300	200

Point 4 — 38.41119 N, 069.70129 E; 1,090 m; km 13; 17:00–19:00; clear, +27 °C.

No.	Species (English)	Latin name	Count	Dir. (°)	Dist. (m)	Alt. (m)
1	Griffon Vulture	<i>Gyps fulvus</i>	2	90	1000	2000
2	Cinereous Vulture	<i>Aegypius monachus</i>	2	180	1000	2000
3	European Roller	<i>Coracias garrulus</i>	3	-	-	-
4	Carrion Crow	<i>Corvus corone</i>	2	-	-	-
5	Common Myna	<i>Acridotheres tristis</i>	15	-	-	-

B5.2 Stage 1 — 9 May 2026

Point 5 — 38.52947 N, 069.85406 E; 1,338 m; 07:00–09:00; clear, +15 °C.

No.	Species (English)	Latin name	Count	Dir. (°)	Dist. (m)	Alt. (m)
1	Griffon Vulture	<i>Gyps fulvus</i>	2	315	3000	2000
2	Common Raven	<i>Corvus corax</i>	2	-	-	-
3	Carrion Crow	<i>Corvus corone</i>	4	-	-	-
4	Eurasian Crag Martin	<i>Ptyonoprogne rupestris</i>	14	-	-	-
5	Common Blackbird	<i>Turdus merula</i>	1	-	-	-
6	White Wagtail	<i>Motacilla alba</i>	2	-	-	-

Point 6 — 38.54289 N, 069.87254 E; 1,362 m; 09:30–11:30; clear, +22 °C. Three Egyptian Vulture nests recorded.

No.	Species (English)	Latin name	Count	Dir. (°)	Dist. (m)	Alt. (m)
1	Egyptian Vulture nest	Neophron percnopterus	1	275	400	450
2	Egyptian Vulture nest	Neophron percnopterus	1	0	450	550
3	Egyptian Vulture nest	Neophron percnopterus	1	15	600	700
4	Egyptian Vulture	Neophron percnopterus	1	75	40	0
5	Egyptian Vulture	Neophron percnopterus	4	315	40	300
6	Carrion Crow	Corvus corone	1	-	-	-
7	Common Nightingale	Luscinia megarhynchos	1	-	-	-
8	Spotted Flycatcher	Muscicapa striata	1	-	-	-
9	White Wagtail	Motacilla alba	3	-	-	-
10	Little Ringed Plover	Charadrius dubius	1	-	-	-
11	Common Sandpiper	Actitis hypoleucos	1	-	-	-

Point 7 — 38.55266 N, 069.88575 E; 1,384 m; 12:00–14:00; clear, +27 °C. Two Egyptian Vulture nests recorded.

No.	Species (English)	Latin name	Count	Dir. (°)	Dist. (m)	Alt. (m)
1	Egyptian Vulture nest	Neophron percnopterus	1	304	700	750
2	Egyptian Vulture nest	Neophron percnopterus	1	304	750	800
3	Barbary Falcon	Falco peregrinus babylonicus	1	-	100	20
4	White Wagtail	Motacilla alba	2	-	-	15

Point 8 — 38.57781 N, 069.91264 E; 1,422 m; 14:20–16:20; clear, +27 °C.

No.	Species (English)	Latin name	Count	Dir. (°)	Dist. (m)	Alt. (m)
1	Egyptian Vulture	Neophron percnopterus	1	-	50	100
2	Common Raven	Corvus corax	1	-	-	-
3	Carrion Crow	Corvus corone	28	-	-	-
4	Eurasian Golden Oriole	Oriolus oriolus	2	-	-	-

Point 9 — 38.61077 N, 069.94663 E; 1,471 m; 16:40–18:40; clear, +26 °C. One bird recorded: Carrion Crow, 1.

B5.3 Stage 1 — 10 May 2026

Point 10 — 38.38088 N, 069.59395 E; 1,566 m; 07:30–09:30; clear, +27 °C.

No.	Species (English)	Latin name	Count	Dir. (°)	Dist. (m)	Alt. (m)
1	Eurasian Golden Oriole	Oriolus oriolus	2	-	-	-
2	Common Nightingale	Luscinia megarhynchos	1	-	-	-
3	Common Blackbird	Turdus merula	1	-	-	-
4	Carrion Crow	Corvus corone	2	-	-	-
5	Eurasian Magpie	Pica pica	1	-	-	-
6	Common Raven	Corvus corax	2	-	-	-
7	Eurasian Hoopoe	Upupa epops	1	-	-	-

Point 11 — 38.38088 N, 069.59395 E; 1,566 m; km 54; 09:40–11:40; foggy and rainy, +12 °C. No birds observed.

Point 12 — 38.51245 N, 069.81502 E; 1,267 m; km 25; 13:30–15:30; overcast, mountain fog, +18 °C.

No.	Species (English)	Latin name	Count	Dir. (°)	Dist. (m)	Alt. (m)
1	Common Myna	Acridotheres tristis	20	-	-	-
2	Brown Shrike	Lanius cristatus	3	-	-	-

3	Eurasian Hoopoe	Upupa epops	1	-	-	-
4	Carrion Crow	Corvus corone	3	-	-	-
5	Spotted Flycatcher	Muscicapa striata	2	-	-	-
6	Common Nightingale	Luscinia megarhynchos	1	-	-	-
7	Eurasian Golden Oriole	Oriolus oriolus	1	-	-	-
8	Passerines sp.		16	-	-	-

Point 13 — 38.47991 N, 069.77149 E; 1,164 m; km 18; 15:40–17:40; overcast, mountain fog, +18 °C. Carrion Crow (2); Passerines sp. (3).

Point 14 — 38.44232 N, 069.73442 E; 1,180 m; km 14; 17:50–19:50; overcast, mountain fog, +18 °C.

No.	Species (English)	Latin name	Count	Dir. (°)	Dist. (m)	Alt. (m)
1	Blue Whistling Thrush	Myophonus caeruleus	1	-	-	-
2	Common Raven	Corvus corax	1	-	-	-
3	Eurasian Hobby	Falco subbuteo	2	-	-	-

B5.4 Stage 2 — repeat survey, 16–18 May 2026

Group 1 (Talbonov, Shodibekov) re-surveyed Points 1–8 on 16 May; Group 2 (Garibmamadov, Safarmamadova) re-surveyed Points 9–14 over 16–18 May. Records were consistent with Stage 1; the nest sites were re-confirmed occupied. Selected notable Stage 2 records: Point 3 (km 2) — the nests were noted to be built in a ravine formed by a landslide; Point 9 (38.54289 N, km 30) — three Egyptian Vulture nests in fissures in rocky cliffs with wind-eroded cavities; Points 10, 11 and 13 — two Egyptian Vulture nests each re-confirmed; a single Barbary Falcon again recorded at the Point 10 / Point 351 cliff face. Full Stage 2 point tables mirror the Stage 1 records above and are retained in the surveyors' technical report.

B6. Raptor Monitoring and Community Consultations (Ergashev, 9–10 May 2026)

On 9–10 May 2026 a field expedition monitored populations of rare and endangered raptor species listed in the Red Book of Tajikistan and the IUCN Red List. Target species included Egyptian Vulture (*Neophron percnopterus*), Cinereous Vulture (*Aegypius monachus*), Bearded Vulture (*Gypaetus barbatus*), Golden Eagle (*Aquila chrysaetos*), Barbary Falcon (*Falco pelegrinoides*), Blue Whistling Thrush (*Myophonus caeruleus*) and Little Forktail (*Microcichla scouleri*). The expedition covered a 56 km route from Baljuvon to the jamoat of Sari Khosor, with 14 key observation points selected for landscape features, potential target-species habitat and maximum visibility.

B6.1 Raptor findings

At observation points within the section between km 2 and km 4 of the route, two raptor nests were identified — one Egyptian Vulture and one Cinereous Vulture. This section falls within the zone of the planned road works, raising particular concern; the report recommends developing measures to minimise impact, possibly by adjusting the works schedule or methodology to avoid disturbing the birds during the critical breeding period. National breeding-population reference estimates cited in support of the PBF assessment are: Cinereous Vulture 40–50 pairs; Bearded Vulture 70–80 individuals; Barbary Falcon 20–25 pairs.

Relationship to the Khursand/Nugzar/Talbonov nests

The Ergashev Egyptian Vulture nest at km 2–4 is the same receptor as the Point 347 / km 2 nest tabulated in Section B4.2 (38.33192 N / 69.68716 E). The Ergashev Cinereous Vulture nest is a separate, additional receptor at the same southern cliff-face cluster. The two bird teams otherwise

recorded non-overlapping nest sites (Ergashev in the south; Khursand/Nugzar/Talbonov at the northern points). See Section B7.

B6.2 Community consultations

The second day was dedicated to gathering information from the local population. Between the villages of Bogi Zogon and Doshmandi, a structured questionnaire survey was carried out with six local residents (items 5 to 10 of the questionnaire). The limited number reflected the small number of households along the route and the weather. Interviews assessed respondents' knowledge of rare fauna (particularly mammals and birds) and gathered information on observations or environmental changes relevant to the road works. The six participants were:

- A game warden of the Baljuvon forestry enterprise;
- A teacher of secondary school No. 28 in the village of Dashtikilko;
- A herder driving livestock from Vakhsh district;
- A resident of Doshmandi village;
- A resident of Doshmandi village;
- A herder driving livestock from Yavan district.

Most respondents demonstrated reasonably good knowledge of local fauna, strongest for frequently encountered species (mountain goats, foxes, wild boar and various birds). With the aid of photographs and brief descriptions, many were able to recognise the Egyptian Vulture and Cinereous Vulture despite their rarity, confirming a useful level of community awareness of Red Book species. The expedition also photographed a confirmed Egyptian Vulture nest and a presumed second nest location.

B7. Data Reconciliation Notes

Three discrepancies between the source reports were identified and resolved as follows for the purposes of the Part A summary and the CHA. They are recorded here in full so that the basis of each decision is auditable.

B7.1 Anzur onion — species and chainage

Muhammadsoleh records the Anzur onion population as *Allium suworowii* between km 33 and km 34, whereas Khanjarov records *Allium stipitatum* (Persian shallot) at approximately km 25. Both are "Anzur" onions, but the species determination and the chainage differ. Pending field reconciliation and status confirmation against the 2024 Red Data Book, both records are retained in Table A2 with the discrepancy flagged.

B7.2 Egyptian Vulture nest count

The consolidated field summary cited "seven Egyptian Vulture nests" by adding the Ergashev km 2–4 nest to the six nests tabulated by Khursand/Nugzar/Talbonov. This double-counts the km 2 nest, which both teams recorded (it is the same receptor at 38.33192 N / 69.68716 E). The defensible confirmed figure carried into the CHA is therefore six Egyptian Vulture nests (one independently corroborated) plus one Cinereous Vulture nest. In addition, two further Egyptian Vulture nests referenced only in the detailed point narrative near km 36 (38.57781 N / 69.91264 E, Point 352 / Point 11) and two near 38.38088 N / 69.59395 E are not tabulated in either stage; these are held as provisional and deferred to the Stage 3 follow-up for verification.