Supplementary Environmental & Social Impact Assessment (ESIA) for Almaty Railroad Bypass Project, Kazakhstan

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Rtendolkar

Rutuja Tendolkar
Partner

Environmental Resources Management (S) Pte Ltd
20 Collyer Quay, #15-01/02
Singapore 049319
T +65 6324 9636

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1. INTRODUCTION

1.1 PREAMBLE

This document, the Supplementary Environmental and Social Impact Assessment ("Supplementary ESIA") Report, has been prepared by Environmental Resources Management (S) Pte Ltd ("ERM") for the Asian Infrastructure Investment Bank ("AIIB") and the International Finance Corporation ("IFC"), collectively referred to as the "Lenders", who are considering financing the construction and operation of the Almaty Railroad Bypass (the "Project"), which is under development by the Kazakhstan Temir Zholy Joint Stock Company (the "Developer" or "KTZ").

This Supplementary ESIA Report has been prepared following a review of the National Environmental Impact Assessment[1] ("National EIA") prepared for the Project as part of the infrastructure permitting process established in the Republic of Kazakhstan (RoK). The key purpose of the review was to provide additional information to the National EIA, to further consider the potential for significant impacts and mitigation measures, where required, to address the gaps identified between the National EIA and IFC Performance Standards (PS) and Good International Industry Practice (GIIP) by the Lenders.

The Supplementary ESIA Report is developed in accordance with the following applicable reference framework:

- Applicable national Environmental and Social (E&S) regulations for linear infrastructure projects.
- International Finance Corporation (IFC) Performance Standards (PS) (2012).
- World Bank Group (WBG) General Environmental, Health, and Safety (EHS) Guidelines EHS (2007).
- WBG EHS Guidelines for Railways (2007).
- WBG EHS Guidelines for Electric Power Transmission and Distribution (2007).
- WBG EHS Guidelines for Construction Materials Extraction (2007).
- IFC Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (2013).
- IFC Good Practice Note: Managing Contractors' Environmental and Social Performance (2017).
- All International Labour Organisation (ILO) conventions signed and ratified by Kazakhstan, all ILO conventions covering core Labour standards and all ILO conventions covering the basic terms and conditions of employment.
- IFC / European Bank for Reconstruction and Development (EBRD) Guidance on Worker Accommodation (2009).

The Non-Technical Summary will be provided in a separate report to explain the key points of the Supplementary ESIA.

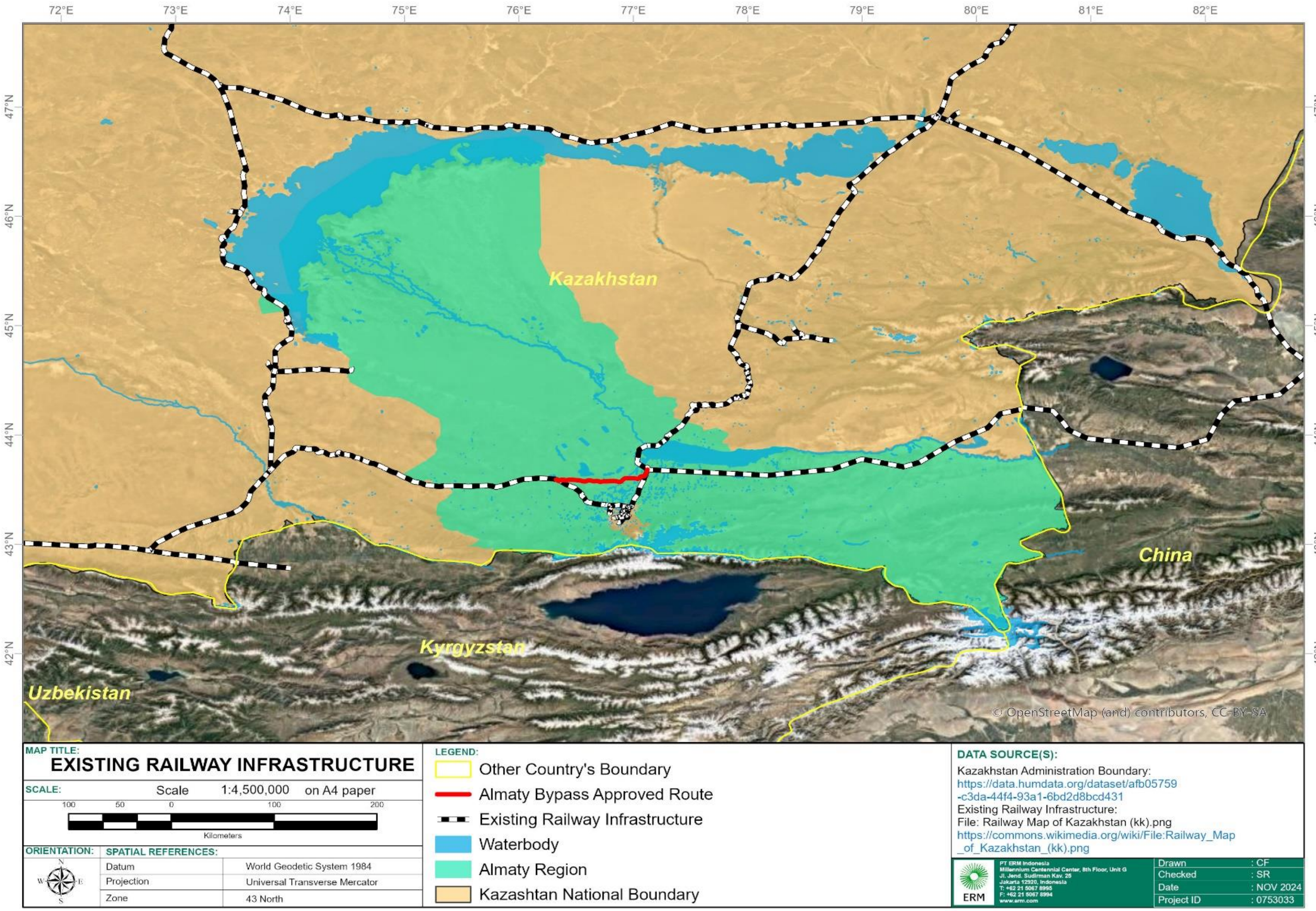
[1] IP "InTech". (2023). Environmental Impact Assessment (EIA)

1.2 PROJECT OVERVIEW

The Almaty Railroad Bypass or the Project in Republic of Kazakhstan (RoK) is a critical greenfield railway infrastructure project between Kazybek Bek and Zhetygen across the districts of Talgar, Iliy, Karasai and Zhambyl. The Project involves developing a national railway as part of the Trans-Caspian International Transport Route (also referred to as the Middle Corridor[2]) designed to resolve the current railway overload and logistics bottleneck around the city of Almaty, while enhancing passenger and cargo transportation efficiency. The location of Almaty Railroad Bypass relative to the existing railway infrastructure is provided in **Figure 1-1**.

[2]The Trans-Caspian International Transport Route or the Middle Corridor is a multimodal transport corridor to enhance trade routes and local connectivity. The Middle Corridor starts from Southeast Asia and China, runs through Kazakhstan, the Caspian Sea, Azerbaijan, Georgia and further to European countries.
Middle Corridor. (n.d.). Trans-Caspian International Transport Route (TITR). Retrieved from https://middlecorridor.com/en/

FIGURE 1-1: PROJECT LOCATION WITH EXISTING RAILWAY INFRASTRUCTURE



The Project involves the construction of a railway bypass with a total track length of 130km (of which approximately 75km is the main track between Kazybek Bek and Zhetygen. The remaining 55km serves as maintenance tracks / branch lines / interchange lines etc.), five (5) stations including three (3) new and two (2) extended/modernised, three (3) main substations (one existing in Kazybek Bek Station, one greenfield in Zhana Arna station (both within the RoW and project components), and one existing PS-Alma-500 substation (not an associated facility) located outside the RoW, connected via a 1.9km 220kV overhead transmission line (OHTL) (project component) to the proposed substation in Zhana Arna, with approximately 500m within the RoW), three (3) switches to guide trains from one track to another, a single-circuit 10kV transmission line (underground), 13 bridges, five (5) rail overpasses and one (1) road crossing (in addition to associated facilities as described in **Section 2 Project Description**).

The key infrastructure permitting approvals obtained are outlined below, and are further detailed in **Table 3-4** (**Section 3.2**):

- The Project design was approved by the Republican State Enterprise "State Non-Departmental Examination of Projects" ("RSE GOS Expertiza") on 20 November 2023 as indicated by a conclusion letter (Ref. 01-0471/23). This approval allows construction to proceed according to the submitted designs.
- The Project power supply and transmission was approved by the Kazakhstan Electricity Grid Operating Company JSC (KEGOC) on 23 October 2023 (Ref. 01-09-08/7262).
- The structures and construction on water bodies, water protection zones and strips were approved by the Balkhash-Alakol Basin Inspectorate for Use and Protection of Water Resources, subject to mandatory requirements, on 24 October 2023 (Ref. KZ96VRC00017833).
- Public hearings held at Talgar, Iliy, Zhambyl, and Karasay district Akimats (local government authority) were conducted on 29 and 30 January 2024.
- The National EIA was approved by the Committee for Environmental Regulation and Control, Ministry of Ecology and Natural Resources of the Republic of Kazakhstan, subject to compliance with specific conditions, on 20 February 2024 (Ref. KZ35VVX00286500). The Project was assigned category II in accordance with the Environmental Code (2021) of the Republic of Kazakhstan No. 400-VI ZRK.

According to KTZ and Integra, all relevant permits for the Project construction have been obtained. KTZ commenced the construction of the Project through the launch of enabling works in November 2023. Thereafter, ground clearance and earthworks were initiated in 2024, and the installation and commissioning of the railway infrastructure and associated facilities are planned for 2025.

The components of the Supplementary ESIA are listed in **Table 1-1**.

TABLE 1-1: DESCRIPTION OF THE SUPPLEMENTARY ESIA AND ASSOCIATED DOCUMENTATION

No.	Document Name	Description
1	Non-Technical Summary (NTS)	This is a stand-alone summary to explain the key points of the Supplementary ESIA to a wider public and set of stakeholders.
2	Main Supplementary ESIA Report	The Supplementary ESIA Report is the central document and contains most of the relevant information and key findings of the impact assessments including appendices. This document also describes stakeholder engagement activities conducted during the preparation of this ESIA performed to the date and by KTZ.
3	Livelihood Restoration Plan (LRP) and a Resettlement Framework (RF)	The LRP is prepared to identify and to address involuntary resettlement impacts due to the project's land and natural resources footprint and to recommend compensation measures, as applicable, to enable livelihood restoration of the project affected persons (PAPs). A Resettlement Framework is prepared to supplement the Livelihood Restoration Plan (LRP) and this Supplementary ESIA. The RF specifies a framework for project affected entities that have had to be physically displaced due to the land acquisition for the Project.
4	Construction Environmental and Social Management System (ESMS) Manual	The Construction ESMS Manual presents the environmental, health & safety and social plans and procedures specific to the construction of the Project, and applicable to all employees including staff, contractors, and sub-contractors.
5	Biodiversity Management Plan (BMP)	BMP is a strategic framework designed to conserve and sustainably manage biodiversity within a specific area or project. It outlines objectives, actions, and monitoring processes to protect ecosystems, species, and genetic diversity while balancing environmental, social, and economic factors. BMPs typically address habitat conservation, species protection, invasive species control, and ecological restoration, ensuring compliance with environmental regulations and promoting sustainable development. By integrating scientific research, stakeholder engagement, and adaptive management strategies, BMPs contribute to long-term ecological resilience and biodiversity conservation.
6	Stakeholder Engagement Plan (SEP) and Grievance Redressal Mechanism (GRM)	The SEP-GRM outlines the process that will be followed in order to listen to, collaborate with, or inform stakeholders about project activities. Development of the SEP involves identifying, mapping and prioritising stakeholders to determine the best tactics for effective engagement. Grievance mechanism is a framework to address complaints and resolve grievances in a timely, effectively and culturally appropriate manner.

No.	Document Name	Description
7	Cultural Heritage Management Framework (CHMF)	The purpose of the CHMF is to protect cultural heritage from the adverse impacts of Project activities and support its preservation. The CHMF outlines three main documents: • Cultural Heritage Screening Checklist: A practical tool designed to assist KTZ in meeting their regulatory requirements and any funding body conditions through identification and assessment of potential impacts on cultural heritage early in the project planning process. • Chance Find Procedure: A procedure to inform users how to manage cultural heritage that is unexpectedly discovered during project construction. • Kurgan Archaeological Landscape Mitigation and Management Guideline: A guiding document to manage and conserve the recorded kurgan sites in the vicinity of the Project during construction or operation activities.

1.3 LIMITATIONS OF THE SUPPLEMENTARY ESIA

At the time of ERM's engagement (Q3 2024), the Project was under construction, as land preparation and construction works had commenced in November 2023. This was confirmed during site visits (September to November 2024) where earthworks and civil construction was observed along the entire alignment. Taking note that land access, excavation, associated earthworks and construction works have already begun, and the timeline constraints imposed to complete the Supplementary ESIA in preparation of disclosure and other timelines associated with the Lender's financing, the purpose of the study was to identify environmental, social and biodiversity sensitivities that were inadequately addressed and critical to the project's successful development. The Supplementary ESIA is intended to address these gaps, provide context and retrospective justification to the work conducted by the existing EIA and where applicable, collect additional information required for the IFC PS-aligned Supplementary ESIA including further actions and recommendations to be taken forward.

The study is based on the information available at the time of preparation, which includes:

- The latest version of the site boundary (including RoW extent on either side of the alignment) made available by KTZ as of December 2024;
- Information and documentation provided by personnel of KTZ and their subcontractors during interviews and site visit;
- National EIA and documentation involved in the Environmental and Social Due Diligence (ESDD);
- Information provided by KTZ and their subcontractors, AIIB and IFC via virtual engagements and email correspondence;
- Observations and findings collected by ERM during the Reconnaissance visit from 23 September – 4 October 2024;
- Observations and findings collected by ERM during the biodiversity site visit from 23 – 28 September 2024;

- Noise quantitative early-stage data collected by ERM during the site visit from 28 October – 8 November 2024;
- Water resources and water quality, and soil and groundwater quality qualitative early-stage data collected by ERM during the site visit from 28 October – 8 November 2024;
- Focus group discussions, key informant interviews and semi-structured interviews conducted with various stakeholders and project-affected persons conducted by ERM during the site visit from 28 October – 8 November 2024;
- Observations of the Project site and associated facilities during various site visits;
- District boundaries approximated through the list of affected land plots made available by the Alatau City Land Department and the list of affected land plots in the IFC Gaps Analysis Report;
- Observations and findings collected by ERM during the third site visit from 15 to 24 January 2025, for the purpose of conducting key informant interviews and semi-structured interviews (SSIs) with PAEs likely to be affected by physical and economic displacement. As the final boundaries of Zhetygen Station have not been finalised by KTZ, the SSIs were conducted based on a list of affected PAEs sent by KTZ to the Alatau City Land Department.

Other data limitations identified, and any efforts taken to address these are documented in the relevant subsections of the Supplementary ESIA.

1.4 PURPOSE OF THIS REPORT

The Supplementary ESIA Report has been prepared following a review of the National EIA prepared for the Project as part of the infrastructure permitting process established in the Republic of Kazakhstan (RoK). The key purpose of the review was to address the gaps identified between the National EIA and IFC PS and Good International Industry Practice (GIIP) by the Lenders.

The Supplementary ESIA was required to review the existing conditions in consideration that construction works are underway, assess the potential impacts against the applicable reference framework and recommend suitable mitigation measures. The remainder of the Supplementary ESIA Report contains the following remaining sections:

- Section 2: Project Description
- Section 3: Applicable Reference Frameworks
- Section 4: Overview of Stakeholder Engagement
- Section 5: Impact Assessment Method
- Section 6: Environmental Impact Assessment (EIA), including biodiversity impacts
- Section 7: Social Impact Assessment (SIA)
- Section 8: Rapid Cumulative Impact Assessment (RCIA)
- Section 9: Environmental & Social Management Plan (ESMP)
- Appendix A: Project Components
- Appendix B: Project Intersections with Gas Pipelines
- Appendix C: Air Emission Sources

- Appendix D: Critical Habitat Assessment
- Appendix E: Minutes of Stakeholder Engagement
- Appendix F: Cultural Heritage Management Framework

2. PROJECT DESCRIPTION

2.1 THE PROJECT SETTING

2.1.1 RAIL INFRASTRUCTURE IN KAZAKHSTAN AND THE MIDDLE CORRIDOR

The Project is located in the territory of Almaty region, Kazakhstan, approximately 60km north of Almaty city centre. The railroad bypass is part of the Altyn-Khorgos border crossing railway route and will facilitate further transits towards four stations: Shu, Aktogay, Altynkol, and Almaty-2. Through these four (4) stations, the railway junction provides transport to the countries and regions described below:

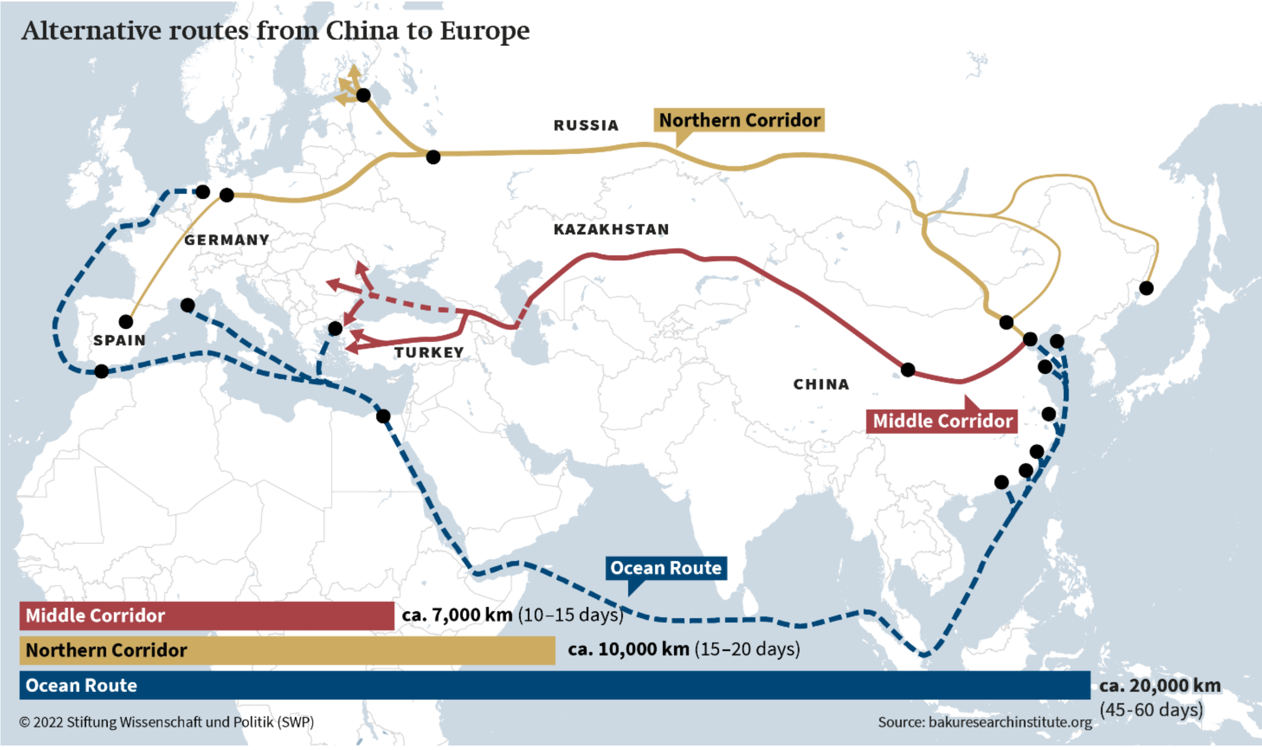
- The Shu station is located west of the Project, in the Zhambyl region of Kazakhstan; the city borders Kyrgyzstan and neighbours Uzbekistan.
- Aktogay is located northeast of the Project, in the Abai region of Kazakhstan, and a major railway hub of the Turkestan-Siberian Railway which connects Central Asia with Siberia.
- East of the project, Altynkol is located in the Almaty region of Kazakhstan and is part of the Altynkol-Khorgos border crossing between Kazakhstan and China.
- South of the Project, the Almaty-2 station is close to the city centre of Almaty and facilitates passenger transport.
- The Project is a vital link in the Middle Corridor, also known as the Trans-Caspian International Transport Route, which connects East Asia to Europe via Central Asia and the Caspian Sea (**Figure 2-1**). The Middle Corridor offers an alternative to the Northern Corridor route (also known as the New Eurasian Land Bridge) through Russia and the Suez Canal and is proving to be an increasingly attractive choice in light of global sanctions on Russia due to the impact of the war in Ukraine[3].
- In the first nine (9) months of 2023, the Middle Corridor saw a surge of 88% in cargo transport volumes, reaching 2 million tons[4]. With the goal to enhance the capacity of the Middle Corridor up to 10 million tons by 2030, Kazakhstan has signed roadmaps with the countries Azarbaijan, Georgia and Turkey to further develop the Middle Corridor and address current bottlenecks by 2027[5].

[3]Eldem, T. (2022). Russia's war on Ukraine and the rise of the Middle Corridor as a third vector of Eurasian connectivity. SWP Comment, 64. Retrieved 26 November 2024, from https://www.swp-berlin.org/10.18449/2022C64/

[4]IFIMES. (2024). The Trans-Caspian International Transport Route and strengthening EU-Kyrgyzstan partnership – Analysis. Eurasia Review. Retrieved 4 December 2024, from https://www.eurasiareview.com/09082024-the-trans-caspian-international-transport-route-and-strengthening-eu-kyrgyzstan-partnership-analysis/.

[5]Satubaldina, A. (2023). Cargo transportation along Middle Corridor soars 88%, reaches 2 million tons in 2023. *The Astana Times.* Retrieved 26 November 2024, from https://astanatimes.com/2023/12/cargo-transportation-along-middle-corridor-soars-88-reaches-2-million-tons-in-2023/

FIGURE 2-1: TRANSPORT ROUTES FROM CHINA TO EUROPE[6]



2.1.2 LAND USE AND SOCIO-ECONOMIC SETTING

The Project runs across four districts in the Almaty region: Karasay, Zhambyl, Iliy, Talgar. As of January 2024, the Zhetygen village and related land plots that are affected by the Project were transferred from the Iliy district and established under a new district called Alatau City. However, since the land acquisition process began in 2023, prior to the administrative transfer, and the transfer of land plots was not finalised as of November 2024, the data collected for the purposes of this ESIA continues to reference the original four (4) districts. This approach ensures consistency in the analysis and avoids discrepancies across the databases collected during the study period.

Prior to acquisition, the primary land use of the Project site was agricultural and grazing land. The population of the Project Area (**Figure 2-2)** is mainly rural, with the exception of Zhetygen village in the Ilyisky district, which was designated as the city of Alatau, a city of regional significance in January 2024, and Talgar town, the administrative centre of Talgar district.

In the Almaty region, 19.5% of the population reside in urban areas while 80.5% reside in rural areas. The four affected districts comprise a total population of 1,056,261 persons as of 2024, with a gender ratio of 1:1 men to women similar to that at the regional level in Almaty and national level.

ERM found that while women and men interviewed suggested that men and women are generally given equal treatment within their communities, women are primarily responsible for

[6]Eldem, T. (2022). Russia's war on Ukraine and the rise of the Middle Corridor as a third vector of Eurasian connectivity. *SWP Comment, 64.* Retrieved 26 November 2024, from https://www.swp-berlin.org/10.18449/2022C64/

domestic chores, agricultural activities, and employment in the education sector, while men are more likely to be engaged in formal work or livestock grazing. In the region, men of working age have a slightly higher employment rate of 94.1% in comparison to women with an employment rate of 86.2%. Of the land plots affected by the Project, 167[7] were privately owned, while the remaining state-owned land were either allocated to KTZ by the state, allocated to other land uses as designated by the state, or leased to private users.

19.84% of the rural population in the Almaty region is primarily employed in agriculture, forestry and fisheries while 16% are employed in wholesale and retail trade. About 30.7% of the working population are self-employed, the majority (83.7%) of which live in the rural settlements of Almaty region. Further information establishing the socio-economic baseline of the Project's Social Area of Influence (SAoI) is described in **Section 7**.

2.1.3 PROJECT GEOGRAPHY AND NATURAL HABITAT

The Project location is characterised by desert, semi-desert and steppe habitats and an arid climate. Summers are hot and dry with a maximum temperature of 24.0℃ and winters are cold and mild with temperatures dropping to -15.0℃[8].

The Project is located along the Ili Depression, a piedmont alluvial-proluvial plain with a slight incline increasing in altitude south towards the Zailiyskiy Alatau mountain range. Snow cover height at the end of winter in the mountains and foothills is greater than 20cm. There is an increase in precipitation and a decrease in temperature in the direction of the mountains. The hydrographic system is the Lake Balkhash basin and the main aquifer of the basin is the Ili River. The Project will intersect the Kaskelen, Malaya Almatinka, Uzyn Kargaly, Zhamankyul, Zhyngyldy and the Karasu Baiserke rivers as well as some irrigation drains. These mixed and glacial-fed rivers originate from rainfall and melting glaciers and snow from the Zailiyskiy Alatau mountain range, part of the larger Tian Shan Mountain system. These rivers will drain to the Balkhash Basin with floods observed in the summer months (Poligram, 2023).

The Project terrain is predominantly situated on loose clastic soils of Paleogene-Neogene and Quaternary age with 2 – 2.5 % of light chestnut soils and up to 1.5% of grey soils. The soil characteristics are fragile, lumpy, alkaline, high carbonate content, and sandy loam to loamy with interlays of silty clays and sands. Groundwater levels in the Project area occur at varying depths from 5 to 30 – 40m with levels at riverine areas at around 5 – 15m. Groundwater levels at the Project site are subject to seasonal changes, with a rise of 0.5 – 2.0m during snowmelt period, and to water availability in irrigation systems (Poligram, 2023).

Vegetation types are predominantly white wormwood and steppe grasses with Tugai vegetation (riparian forest or shrubland vegetation found along riverbanks and floodplains in Central Asia), shallow reed depressions and swamps in the river valleys. Crop cultivation occurs in areas with meadow-chestnut soils to grow mainly corn and sunflowers (Poligram, 2023). The primary land use of the Project is for livestock grazing.

One site of higher biodiversity conservation significance was identified within 10km of the project area, namely, the Sorbulak Lake System (the project passes through the Key

[7] Prior to the addition of the 10 additional land plots in Alatau City as of January 2025, the total number of privately owned affected land plots by the Project was 157.
[8] Poligram. (2023). Technical report based on the results of engineering and hydrometeorological surveys for the preparation of project documentation 754189/2022/1-Y.3. Poligram.

Biodiversity Area (KBA) and Important Bird Area (IBA)). The alignment overlaps with the designated KBA boundary for a ~4km stretch with the Sorbulak Lake waterbody located ~5km north of the railway alignment. Additionally, the alignment is ~10km to the south of the KBA wetlands.

2.2 ALIGNMENT OVERVIEW AND PROJECT COMPONENTS

The main track is 75km in length and will connect the Almaty-1-Chu railway line at Kazybek Bek Station and the Almaty-1-Aktogay line at Zhetygen Station. The Project consists of passenger and freight railway service with five (5) train stations and auxiliary facilities. The construction involves an estimated earthworks volume of 6,221,608m^3, 19 crossings and deploying 597 construction staff and 234 pieces of construction equipment. The project map is presented in **Figure 2-2**.

The Project commenced construction in November 2023 with land clearance and earthworks ongoing from Q2 2024 across three sections of the route (east, west and central parts). According to the construction plan provided by KTZ, the main production base for the construction of the railway project is planned at Zhetygen station. This base will handle the assembly and storage of rail-sleeper grids (RShR) and turnouts. However, this is to be confirmed by Integra, the EPC contractor. The assembled sleepers and other materials are transported to the construction sites by rail. The installation and commissioning of the railway infrastructure and associated facilities is planned for 2025. The overall construction duration is estimated to be two (2) years as shown in **Table 2-1**[9], the operational lifespan of the trainline is unavailable at the time of writing and is assumed to be 30 – 50 years[10,11].

[9] KTZ. (2024, November 7). Прил. 1. Календарный график. KTZ.
[10] Rail Magazine. (2024, March 14). Rolling stock panel dismisses idea of shorter lifespan trains. Rail Magazine. Retrieved June 17, 2024, from https://www.railmagazine.com/news/network/rolling-stock-panel-dismisses-idea-of-shorter-lifespan-trains
[11] The Geography of Transport Systems. (n.d.). Transport assets lifespan. Retrieved June 17, 2024, from https://transportgeography.org/contents/chapter3/transportation-and-economic-development/transport-assets-lifespan/

FIGURE 2-2: OVERVIEW OF THE RAIL ALIGNMENT

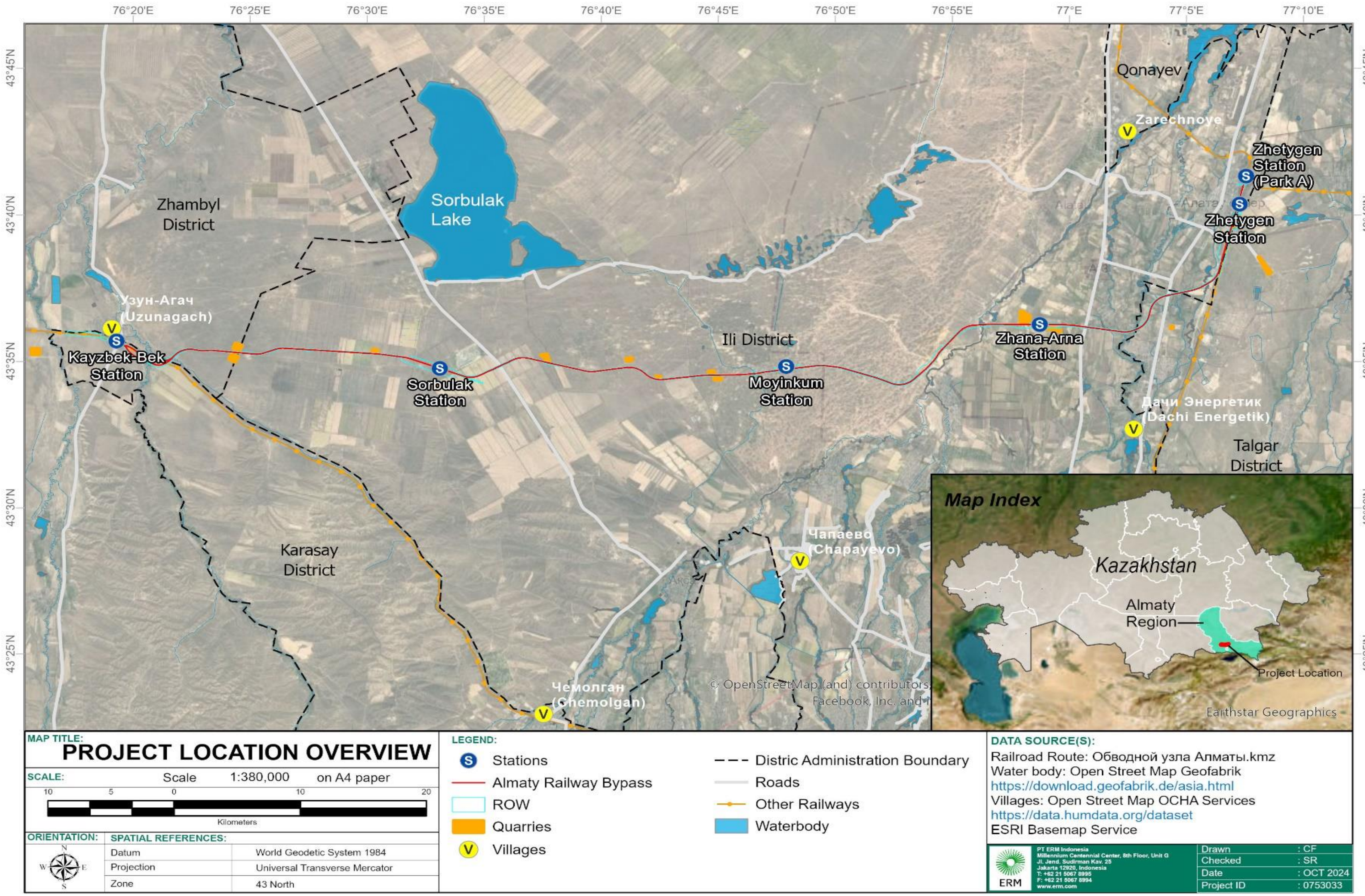


TABLE 2-1: PROJECT CONSTRUCTION SCHEDULE

No.	Type of work	Duration of construction, months																								
		2023	2024												2025											
		Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Land Preparation																										
1	Land preparation for stations and alignment sections between stations	■	■	■	■	■	■																			
Construction																										
2	Temporary buildings and structures	■																								
3	Earthworks					■	■	■	■	■	■	■	■													
4	Energy infrastructure and facilities[12]		■	■	■	■	■	■	■	■																
5	Bridges		■	■	■	■	■	■	■	■	■															
6	Drainage culverts					■	■																			
7	Vertical signalling posts and railway crossings									■	■		■	■												
8	Auxiliary and services facilities at stations						■	■	■	■	■	■	■													
9	Network lines[13], water supply, sewage, heating and gas supply facilities at stations										■	■	■	■												
10	Landscaping at stations																■	■	■	■	■					
11	Commissioning and adjustment works														■	■	■	■	■	■	■	■	■	■	■	■

[12] Inclusive of overhead transmission lines, substations, and transformers.
[13] Inclusive of fibre-optic transmission systems and operational and technological communication systems.

The Project has been assigned Category II according to The Environmental Code of the Republic of Kazakhstan dated 2 January 2021 No.400-VI ZRK, which entails moderate negative impact on the environment (there are four (4) categories in total, and Category I implies major impacts).

The project is comprised of the following key components listed below, with a detailed list of the project components and supporting figures presented in **Appendix A**.

- The length of the railway bypass main track from Kazybek Bek and Zhetygen is approximately 75km with the total track length of 130km due to double lines and station layouts. The project footprint comprises of:
  - 300m wide Right of Way (RoW) (150m on either side of the line) at the train stations with a 10 m railway line footprint included
  - 160m wide RoW (80m on either side of the line) for the construction of railway sections between the stations with a 10m railway line footprint included.
- Sanitary Protection Zone (SPZ) refers to a specially designated area established around infrastructure, or other sources of potential pollution to protect the health of nearby populations and the environment. As the project is registered as a sanitary hazard class IV, for which a sanitary protection zone of at least 100m (established from the centre of axis of each railway track) is required. The majority of the stations and the alignment will have no line fencing[14].
- There are five (5) stations (three (3) new and two (2) extended) for freight and passenger trains including new depots, maintenance and servicing facilities, accommodation[15] for station employees, and other supporting infrastructure as detailed in **Appendix A**. Train stations will include new access roads, sidewalk pavements, landscaped areas and other areas.
  - The existing Kazybek Bek Station will be expanded. There will be freight transport between Kazybek Bek Station and Zhetygen Park B Station along the bypass. There will be freight and passenger transport as part of the Kazybek Bek – Almaty 1 and Kazybek Bek – Otar lines.
- Zhetygen Park B Station will be newly constructed and connected to the existing Zhetygen Park A Station. Both Zhetygen Stations will provide passenger and freight transport. There will be passenger and freight transport as part of the Zhetygen Park B – Aktogay line but only freight transport from Zhetygen Park B Station along the bypass.
- No new rolling stock is expected to be purchased for the Project. While the Kazakh government is working to renew KTZ's fleet of rolling stock, the efforts are parallel to and separate from the Project[17].
- 6.622 322 3At Kazybek Bek Station, there are train passes from the existing Almaty-Shu and Almaty-Otar lines. A 200m long track to perform shunting operations using diesel shunting locomotives at the station will be constructed. Kazybek Bek Station is part of the Almaty-Otar line, a double track line with AC electric traction. Power supply for the

[14] Zhetygen B Park will have line fences at the receiving and departure tracks.
[15] Housing capacity for station employees is unavailable at the time of writing. It is expected that there will be approximately 500 employees hired during the operational phase.

signalling system is connected to a substation with two existing power supply lines AB-10 kV and DPR-27.5 kV.

- At the existing Zhetygen Station A, there are train passes from the existing Almaty-Aktogay and Zhetygen-Kairat lines. A track to perform shunting operations using diesel shunting locomotives will be constructed (length unspecified).
  - The new Zhetygen Station B will receive trains from the direction of Shu, Kazybek Bek, Altynkol, Aktogay and Almaty.
- According to the OPZ (Poligram, 2023), the estimated number of station employees:
  - Kazybek Bek Station - Five (5)
  - Sorbulak Station – Six (6)
  - Moyinkum Station – Six (6)
  - Zhana Arna Station – Six (6)
  - Zhetygen Station - 45
- There will be three (3) 500/220 kV substations connecting the Project through 220kV overhead lines supplied by the Kazakhstan Electricity Grid Operating Company (KEGOC) (70-80% coal electricity generation).
  - One 220/2x25/27.5/10 kV electrical substation at the existing Kazybek Bek Station
  - One 220/27.5/10 kV at a new greenfield substation at the proposed Zhana Arna Station
  - The greenfield substation at Zhana Arna will be connected via a 1.9km overhead transmission line (OHTL) of 220kV to an existing substation at Alma-500. The Alma-500 substation is located outside the RoW.
- There will be a single circuit 10kV transmission line (73km) that will be constructed underground, along the alignment and within the RoW. The transmission line will be positioned about 10-15m left or right of the alignment, depending on the situation[16].
- There will also be a DPR-27.5kV longitudinal power supply line that powers auxiliary systems such as signalling and communication equipment along the entire length of the alignment with supporting maps presented in **Appendix A.** This is an overhead contact network.
- There will be a fibre optic cable with a capacity of 24 optical fibres that conforms to the International Telecommunication Union (ITU) G.652 standard for the support of a communication network. The cable (VOK-24) will be laid underground in a polyethylene pipeline. The communication system for technical purposes includes a station administrative telephone communication, two-way loudspeaker, station radio communication, local network connectivity, video surveillance systems, electrical centralization post, and office and technical buildings are equipped with local network connectivity and radio.
- According to ERM's January 2025 Site Clarifications Excel, there will be natural gas venting as a one-time event during the construction phase. There will be three branches of the main gas pipeline – threads A, B and C. The existing natural gas pipeline will be shut off

[16] According to clarifications from Poligram on 16 January 2025.

for 30 days during construction before being reconnected with upgraded sections of the gas pipeline. The gas built up in the existing main pipelines will need to be vented.

- There are large scale earthwork activities (6.2 million m^3 in volume) due to the complex relief and challenging technogenic conditions (i.e., quick sands, mudslide areas, unstable ground, etc.) requiring replacement of geotechnically unsuitable ground. There are 14 quarries identified for the localised extraction of structurally stable substrate accessible via unpaved access roads as shown in **Figure 2-2** and in **Section 6.5**.
- According to the OPZ (Poligram, 2023), the supply of ballast stones for the construction of the railway track will be transported by train from a quarry at Malaysary Station 120 km to Zhetygen Station and by trucks along the alignment. Details of other construction materials are not available at the time of writing.
- There are construction worksites including laydown areas at the stations, along the railway alignment, culverts, bridges and quarries. There are some worker rest areas in freight containers and material laydown areas at the time of writing. At the time of writing, the details of the worker rest areas (number and design) are unavailable.
- There was one construction labour camp at Sorbulak Station and one camp at Zhana Arna Station[17]. As of 17 January 2025, KTZ and Integra have informed that there are no more construction camps.
  - During ERM's site visit from 28 October – 8 November 2024, the site team visited one labour camp at Sorbulak station (Latitude: 43.574202º N, Longitude: 76.608032º E) with beds, toilets, a boiler system, hot and cold water, an existing groundwater well, connectivity to transmission power lines, kitchen and bakery and a wastewater tank. The camp is built on an existing farmland with an agreement between Integra's subcontractor and the farmer. The camp is located 4.6km east of the Sorbulak Station.
- There will be workshops, such as a service and technical building at Kazybek Bek Station, associated equipment sheds at Moyinkum Station, material warehouses at interim stations and a depot at Zhetygen Station.
- During construction, the project draws groundwater from nine (9) groundwater wells along the alignment. At the time of writing, the design and groundwater level of these wells used during construction were unavailable. The National EIA estimated the water demand for the construction phase as per SP RK 4.01-101-2012. The primary water requirements are for household and industrial purposes. The use of groundwater includes domestic use for workers' daily consumption during the construction period and industrial water needs including the water required for construction activities such as concrete preparation. Details are discussed in **Section 6.5**.
- The existing municipal waste landfill at Kazybek Bek will be utilised for construction waste and general waste during construction.
- Wastewater generated during construction will be transported off-site by a contracted third-party collector. The off-site location of the transported construction wastewater was not available at the time of writing. Operational wastewater will be treated at on-site

[17] As of 17 January 2025, the Project is in the late stages of construction, KTZ and Integra have informed that there are no more construction camps. They mentioned that the labour accommodation camps were not planned for the Project, and they were temporarily organised between the subcontractors and landowners. KTZ highlighted that they did not have any information on labour camps. During the initial and mid-phase of construction of the Project

wastewater treatment facilities. Treated wastewater will be used to irrigate green spaces at stations. Further details will be discussed.

- The project will utilise existing off-site concrete mixing plants near Kazybek Bek Station and Taldykorgan City for reinforced concrete and metal structures of bridges and culverts[18].
- Concrete to be used for the construction of stations will be mixed on site at temporary batching plants.

2.2.1 OPERATIONAL DESIGN

- During ERM's site visit, KTZ stated that no hazardous cargo would be carried via freight trains.
- According to the Operational Design[19] (OPZ) and the National EIA, there are five (5) railway overbridges[20], one (1) road overbridge[21], six (6) cattle crossing bridges[22], six (6) river-crossing bridges, one (1) ravine-crossing bridge, 11 level crossings[23] and 59 concrete drainage culverts[24] as detailed in **Appendix A**.
- The two (2) types of electric locomotives that will run along the bypass are VL-80-S (ВЛ-80-С) with a maximum speed of 110 km/hour and KZ-8A with a maximum speed of 120 km/hour.

FIGURE 2-3: ELECTRIC LOCOMOTIVE VL-80-S (LEFT) AND KZ-8A (RIGHT)

[18] Poligram. (2023). Project construction management (POS).
[19] Poligram LLP. (2023). *Operational design (OPZ), Ref. 754189/2022/1-OPP*.
[20] Railway overbridges are railway bridges that cross over existing railway lines. The indicative engineering design does not allow for pedestrian traffic across the bridge.
[21] A road overbridge is where a vehicular bridge is built over the alignment. The indicative engineering design does not allow for pedestrian traffic across the bridge.
[22] Cattle crossing bridges are reinforced concrete bridges built along the alignment to allow cattle and people to pass under the railway bridge
[23] Level crossings are road crossings at the same level as the railway line without any elevation changes. It is expected that pedestrian traffic has access to this crossing as no indicative engineering design was available at time of writing.
[24] The National EIA sated there were 48 culverts intersecting watercourses as part of the Project, however, recent site visit in January 2025 confirmed that there were now 59 culverts due to households requesting for culverts. The railway was cutting through viable land plots and households lost access to water sources for irrigation

- The Project will use R-65 rail tracks with R-65S rail tracks only used at stations with SKL-30 bonding[25]. No design trainline speed at different railway sections was available.
- Rolling stock between the Kazybek Bek and Zhetygen Park B stations will utilise electric locomotives.
- For the operation of freight trains along the Shu-Kazybek Bek-Zhetygen Park B line (including the bypass), locomotives and locomotive crews will be provided from the Shu operational locomotive depot and the Zhetygen turnaround locomotive depot with rest periods at Shu or Zhetygen Stations. This line will not include passenger trains.
- All stations will be integrated into the "Neman" dispatching centralisation under the management of the Almaty-Otar Circle Dispatching and Control Centre.
- Zhetygen Station A and Kazybek Bek Station have existing control and technical inspection points with an automatic monitoring system to monitor the technical conditions of rolling stock.

2.2.2 MAINTENANCE ACTIVITIES

For the maintenance of rolling stock, KTZ has accounted for the following activities:

- Inspection points at Zhetygen Park B Station, Moyinkum Station and Kazybek Bek Station
- Maintenance and repairs at Zhetygen Park A and Zhetygen Park B Stations
- Continuous monitoring using an automatic system (KTSM devices)

KTZ estimates that by 2035, there will be a total of 405 members of staff in relation to the operations and maintenance of the rolling stock. In particular, there will be one (1) Point of Control and Technical Inspection Master responsible for overseeing the inspection and maintenance of rolling stock at the control points as well as 248 maintenance staff. The maintenance of the newly built station tracks, and the related infrastructure such as culverts, bridges and overpasses will be carried out by the operational division within KTZ, and is expected to involve 66 personnel. The current capacity of KTZ to absorb the maintenance activities of the Project is unknown, and the number of personnel to be hired to cover the new line is yet to be determined.

2.3 ORGANISATIONAL RESPONSIBILITIES

The key parties responsible for the Project:

(1) <u>Developer / Operations and Maintenance</u>

- **Kazakhstan Temir Zholy ("KTZ")** is the developer of Almaty Bypass Project. It is a 100% state-owned enterprise established in 2002 and owns and operates all the state railway network.

[25] R-65: Rail profile manufactured according Russian Standard Gost P51685, mass 64,87 kg per meter
ArcelorMittal. (n.d.). *Rail R65: Rail profile manufactured according to Russian Standard Gost P51685, mass 64.87 kg per meter*. Retrieved January 2025, from https://rails.arcelormittal.com/profiles/transport-rails/russian-standards/rail-r65/SKL30 Rail Tension Clamps is also called rail clip, rail spring clamp, rail spring clip, it is made from spring steel, used for fastening the rails on kinds of railway lines, used for Light Rail System/Conventional Ballasted Line/ High-speed Lines
Railway Fasteners. (n.d.). *SKL30 Rail Tension Clamps*. Retrieved January 2025, from https://www.railwayfastener.com/Products_details/1228008044718403584.html

(2) Construction

- **Integra Construction KZ LLP ("Integra")** is the appointed Engineering Procurement and Construction (EPC) Contractor responsible for the construction and project management. Integra is responsible for the earthworks and other subcontractor works.
- **Poligram LLP ("Poligram")** is the appointed design engineer for the Project. Poligram developed the Operational Design Report (2023) and the Engineering and Hydrometeorological Report (2023) for the Project.
- **Joint Stock Company Intergas Central Asia ("Intergas Central Asia")** is the appointed Liquefied Petroleum Gas (LPG) supplier for the Project. LPG is supplied via a gas pipeline named the Asian gas pipeline. Intergas Central Asia operates two gas pipelines that intersect the Project once each: the "Almaty-Taldykorgan" pipeline and the "Almaty-Bayserke-Talgar" pipeline. Additionally, the Kazakhstan-China Asian Gas Pipeline intersects the Project twice. Refer to **Appendix B** for more information.
- **Kazakhstan Electricity Grid Operating Company ("KEGOC")** is responsible for the supply of electricity and the construction of certain sections of overhead power lines (see **Table 2-2)** for the Project. KEGOC is the state-owned national operator of the electricity transmission system in Kazakhstan.
- **Alatau Zharyk Kompaniyasy ("AZhK JSC")** is responsible for the construction of overhead power lines for the Project. AZhK JSC is a power transmission organisation operating in and surrounding Almaty.
- **Geo Energy Group LLP ("Geo Energy")** is responsible for geological studies and research in the project.
- **Antique KZ LLP ("Antique")** was the appointed Cultural Heritage consultant of the Project by Poligram based on the terms of contract No. 002-2023 between Antique-KZ and Poligram on 07 March 2023. Antique provided cultural heritage services to Poligram during the detailed design stage and issued their historical and cultural findings in the letter 2023/003 "Historical-Cultural Expertise Conclusion" dated 27 March 2023. At the time of the Supplementary ESIA Study, Antique's involvement in the Project had ceased.
- **Margulan Institute of Archaeology ("Margulan")** of the Committee of Science of the Ministry of Science and Higher Education of the Republic of Kazakhstan was first engaged by KTZ in 2014 as a Cultural Heritage licensed expert to conduct cultural heritage studies on the site. The engagement included a study which findings were reported in the letter No. 54/20-381 on 3 December 2014. Subsequently, Margulan was engaged for another cultural heritage study in the letter No. 54/20-480 dated 01 November 2024. The latest findings for determining the presence of critical cultural heritage objects to be included in the Supplementary ESIA were supplemented by this latest report by Margulan.
- **IP InTech ("InTech")** was the appointed EIA Consultant of the Project. The company also developed the Waste Management Program (2024), Industrial Environmental Control Program (2024) for the Project.
- **San Munai Gas LLP ("San Munai Gas")** is responsible for the Engineering and Geological report (2023) for the Project.
- **Committee for Environmental Regulation and Control (CERC), Ministry of Ecology and Natural Resources of the Republic of Kazakhstan** is responsible for approvals and

permits related to the National EIA. CERC is responsible for enforcing environmental laws, issuing permits, and ensuring compliance with environmental standards.

- **Balkhash-Alakol Basin Inspectorate for Use and Protection of Water Resources, Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan** is responsible for approvals related to construction works on water bodies, water protection zones for the Project. The inspectorate regulates the use of water resources in the Balkhash-Alakol basin, ensuring compliance with national water laws and sustainable practices. It monitors water bodies to prevent pollution and manage water quality, addressing issues arising from industrial discharges and agricultural runoff, and enhances integrated water resource management practices in the region.
- **Republican State Enterprise "State Non-Departmental Examination of Projects" ("RSE GOS Expertiza")** is responsible for evaluation of the Project against Kazakhstan regulations. RSE GOS Expertiza operates under the Ministry of Industry and Infrastructure Development and assesses the quality and compliance of construction projects with legal and technical standards.

(3) **Project Approvals**:

- **National Company QazAvtoJol JSC ("QazAvtoJol"), Almaty Regional Branch** is responsible for managing and approving permits related to the construction, maintenance, and operation of roads and transportation infrastructure within Kazakhstan, especially in the Almaty region. QazAvtoJol is a state-owned enterprise in Kazakhstan that manages, maintains, and develops the country's infrastructure such as roads and bridges. They oversee approvals for road construction and maintenance permits, permits for implementing temporary closures and permits for installation of infrastructure within the RoW of public roads.
- **Department of Construction, Architecture and Urban Planning of Zhambyl District** (Ref. KZ46VUA00866819, dated 4 April 2023). A governmental body in Kazakhstan responsible for overseeing construction projects, urban planning, and architectural development within the Zhambyl region.
- **Department of Construction, Architecture and Urban Planning of Ili District** (Ref. KZ31VUA00867380, dated 4 April 2023). A governmental body in Kazakhstan responsible for overseeing construction projects, urban planning, and architectural development within the Ili region.
- **Department of Construction, Architecture and Urban Planning of Karasai District** (Ref. KZ37VUA00867369, dated 4 April 2023). A governmental body in Kazakhstan responsible for overseeing construction projects, urban planning, and architectural development within the Karasai region.
- **Department of Construction, Architecture and Urban Planning of Talgar District** (Ref. KZ85VUA00871840, dated 10 April 2023). A governmental body in Kazakhstan responsible for overseeing construction projects, urban planning, and architectural development within the Talgar region.
- The **Akimats** of Talgar, Zhambyl, Iliy, and Karasay within the **Almaty Oblast** are the district proponents engaged directly through KTZ to direct, inform, facilitate and coordinate the land acquisition process.

2.4 PROJECT REQUIREMENTS

A summary of the resources required and pollution sources for the Project is presented in **Table 2-2.**

TABLE 2-2: RESOURCE REQUIREMENTS

Resource	Construction	Operation
Land	An estimated 284 land plots[26] with an estimated area of 1,056.43 hectares (permanent land acquisition) is required for the development of the Project, across four districts: Karasay, Zhambyl, Ili and Talgar.	

	• 14 Quarries[27] estimated at 181 hectares (temporary land procurement during the construction phase from land provided by the Akimats):
	  o Four (4) quarries (57.06 hectares) are partially intersecting the RoW: no.s 4, 7A, and 14A, 16
	  o 10 quarries (123.88 hectares) are outside of the RoW: no.s 2, 3, 5, 6, 7, 8, 9, 20A, 20B and 30
	  o Of this, approximately 6 hectares of the temporary land requirement for quarries lie within the existing RoW for the Project. Approximately 175 hectares of land outside of the Project RoW will be temporarily procured for quarries.
	• RoW (varying between 50m along the alignment to 500m at the railway stations).
	
	• Two (2) construction labour accommodation camps at Sorbulak station and Zhana Arna station.
	• Four temporary roads of the following approximate lengths: 360m, 360m, 430m and 740m.
		• The Kazybek Bek Station and its facilities: 54,800m^2. (inclusive of existing substation)
		• The Sorbulak Station and its facilities: 40,800m^2
		• Moyinkum Station and its facilities: 30,300m^2.
		• Zhana Arna Station and its facilities: 47,000m^2. (inclusive of the proposed greenfield substation)
		• The Zhetygen Station and its facilities: 90,000m^2.
		• 73km 10kV underground power transmission lines.
		• Rail alignment, inclusive of RoW and associated facilities (based on project boundary provided by KTZ) is approximately 13.2km^2.
		• Rest house for 20 workers at Zhetygen Station: two-storey building 31m x 12.6m = 391m^2.

Project transmission lines and substation	• There are three (3) substations for the project:
	  o One in Kazybek Bek Station, which is existing and within the RoW
	  o One new greenfield substation, to be built at Zhana Arna substation, and within the RoW.
	  o One existing substation at PS-Alma-500, which is outside the RoW. This substation will connect e the Zhana Arna substation via a 220kV OHTL, of approximately 1.9km (of which 500m is estimated to be within the RoW).	

[26] Previous figures estimated the land acquisition to affect 274 land plots at 1033 hectares. As of 4 December 2024, after consultations between KTZ and Alatau Akimat, it was estimated that additional land plots previously unaccounted for are required for acquisition in Zhetygen village, part of the newly formed Alatau City. This has been estimated to 10 land plots, with KTZ identifying these land plots. The figures for the 10 additional land plots have been included in this assessment of land requirement

[27] While temporary land procurement may be in the construction phase, the permanent land acquisition is shown in the pre-construction or planning phase of the project.

Resource	Construction	Operation
	• Easements for the RoW and land required for the 1.9km 220kV OHTL connecting PS-Alma-500 to Zhana Arna will need to be acquired by KTZ[28].	
Labour	• In total, the overall workforce is estimated at 1,500 workers, with the average workforce at 600 workers during the construction period, with peak construction workforce at 700 workers[29] (previous estimates were 1,400 workers hired at peak construction)[30], with 1,075 workers subcontracted for earthworks and linear construction.	Approximately 500-600 workers will be hired in the operational phase[31,32]. According to the OPZ provided by KTZ, the required staffing includes: • 68 employees across the five stations for station operations and maintenance. • 66 members of staff responsible for the maintenance and repair of the contact network, traction substation, sectioning posts, power supply and telemechanic devices • The operations of the Carriage and Control Station involving the PKTO Master, operators and the inspectors in charge of carriage repair amounting to 405 employees by 2035.
Water Supply	• Total volume of potable water consumed for the entire construction period is 18,323m^3 [33]. • Total volume of technical and chemical water that will be used for concrete production and for dust suppression for the entire construction period is 75,731m^3 [34].	• Total water consumption is calculated to be 60m^3/day and 21,918m^3/year. • Operation water usage include the following: • water required for the locomotive equipment and inspection depot • Electrical stations • Control and technical points for wagons • Rest houses

[28] KTZ will need to acquire land for tower footprint and RoW for the alignment for this 1.9km 220 kV OHTL, as per Livelihood Restoration Plan (LRP) principles. As of January 2025, KTZ has not yet identified the alignment of the 1.9km 220kV OHTL, and thus, the land required for the OHTLE tower and the easement of the RoW has not yet been identified for acquisition.
[29] This figure has been updated since the January 2025 site visit, and from the Draft version 1, as the previous figure indicated 1,400 workers during peak of construction.
[30] Railway Pro. (2023). Almaty rail bypass construction launched. Railway Pro. Retrieved November 25, 2023, from https://www.railwaypro.com/wp/almaty-rail-bypass-construction-launched/
[31] This figure has been updated since the January 2025 site visit, and from the Draft version 1.
[32] Railway Pro. (2023). Almaty rail bypass construction launched. Railway Pro. Retrieved November 25, 2023, from https://www.railwaypro.com/wp/almaty-rail-bypass-construction-launched/
[33] Total potable water consumed for the entire construction period, as per the National EIA. Section 8.3 of the National EIA estimates that, for the construction period, the total number of employees is 1004 people, with a water consumption rate for workers at 25 litres per day. The following calculation is given of 1004*25/1000 = 25.1 m3/day; 25.1 * 730 = 18323 m3/period.
[34] Total consumption of technical and chemical water for production needs, including the production of concrete for the entire construction period, as per the National EIA Section 8.3.

Resource	Construction	Operation
		• Administrative and Household Building • Boilers and boiler rooms • Duty points • 2-apartment residential buildings
Power Supply (Electricity)	• Total electricity consumption is projected to be 1,200,000 kWh.	• Estimated annual electricity consumption is 85,600,000 kWh[35].
Liquified Petroleum Gas (LPG) supply	• Total expected consumption of LPG is 12,000 L[36].	• Projected LPG consumption is 1,500 L/year.
Soil	The volume of soil to be excavated is an estimated 1,562,619m^3. The volume of soil to be filled is an estimated 4,658,989m^3. The total volume abstracted during the earthworks phase is an estimated 6,221,608m^3.	
Vegetation clearance	The construction will result in the loss of a total loss of approximately 12,220 trees[37]. The percentage of plantation trees cleared is not made known to ERM. From site observations and information provided by KTZ, it is known that most trees are plantations, except for the ones around the riverine habitat.	
Wastewater	Total volume of construction wastewater disposal is estimated to be 18,323 m^3/year.	Total wastewater disposal is calculated to be 52 m^3/day and 18,961 m^3/year.
Solid waste	Total waste generated is an estimated 79,446 tons[38].	Total waste generated is an estimated 62 tons/year.
Hazardous waste	Total waste generated is an estimated 2.75 tons.	While no information was made available on hazardous waste during operations, based on the precautionary principle, ERM has assumed that there is a risk of contamination due to hazardous waste (for e.g. due to diesel oil leakage and improper management of toxic chemical waste and wastewater generation).

[35] Estimated by aggregating and analysing information on a list of equipment and customers (including households), running time, power consumed, etc; the sum power required to run the electrical motor, or any electrical machine + power consumption during winter, summer, (seasonal), day, night, etc. (Clarifications with Poligram on 16 January 2025).
[36] Based on information from the Project Components, and clarifications on site, there are two gas pipelines and Intergas Central Asia is the appointed LPG supplier for the Project. The gas pipelines intersect the project in three locations, and the LPG is stored in LPG storage tanks in the following locations: Kazybek Bek Station, Sorbulak station, Zhana Arna station, and Zhetygen Station. The remainder of the alignment is supplied with LPG through LPG pipelines.
[37] The National EIA states that 44,572 trees are along the alignment. Clarifications with Poligram in January 2025 indicated that approximately 10,000 trees need to be cut, and that 44,572 trees included all the trees within the RoW, however only the trees in the way of the railbed are actually removed.
[38] Including the removal of the 10,000 trees in the calculation for solid waste.

2.5 CONSIDERATION OF ALTERNATIVES

IFC Performance Standard 1 (Assessment and Management of Environmental and Social Risks and Impacts) ("PS1") requires an assessment process that identifies the risk and potential impacts associated with a project. Specifically, "the process may comprise a full scale environmental and social impact assessment, a limited or focused environmental assessment or straight forward application of environmental siting, pollution standards, design criteria or construction standards". PS1 states that for greenfield developments or large expansions with specifically identified physical elements, aspects and facilities that are likely to generate potential environmental or social impacts, the client will conduct a comprehensive ESIA, including an **examination of alternatives,** where appropriate.

At the time of engagement (late 2024 to early 2025), KTZ informed ERM that while there were considerations of alternative designs as set out in the following subsections, alternatives such as electrification (versus diesel) and the number and location of substations, freight only operations versus freight and passenger operations had already been decided upon. ERM was not able to obtain insights into earlier Project design decisions. The following subsections outlines the design alternatives the Project had considered, and which were made available to ERM.

2.5.1 PROJECT VS NO PROJECT SCENARIO

Environmental and social impacts were compared between the No Project Scenario and the Project Scenario as summarised in **Table 2-3.**

TABLE 2-3: COMPARISON OF E&S IMPACTS BETWEEN THE PROJECT AND THE NO PROJECT SCENARIO

No.	E&S Impact	Project Scenario		No Project Scenario	
		Positive Impacts	Adverse Impacts	Positive Impacts	Adverse Impacts
1	Air quality	• A less congested train system in Almaty city may reduce train idling times and reduce the consumption of coal generated electricity. This may decrease emissions of CO_2, SO_2, NO_x, particulate matter (PM) and mercury from coal-fired power plants. • The existing Almaty city train system may operate more efficiently at optimal speeds, reduce electricity consumption and associated emissions from coal-fired power plants. • Intensity of train traffic in Almaty city will improve as rolling stock will be diverted outside the city. This may reduce PM emissions from wear and tear of train components.	• Earthworks, excavation and structure building activities may increase PM emissions and adversely affect sensitive receptors. • PM, NO_x and CO emissions may increase due to diesel combustion in construction machines and trucks carrying materials to and from the construction sites. • Increased electricity consumption from railway operations will lead to an increase in emissions of CO_2, SO_2, NO_x, PM and mercury from coal-fired power plants.	• Absence of adverse impacts associated with the Project Scenario.	• Potentially increased levels of PM and NO_x emissions associated with a congested train system in Almaty city. • A congested train system can lead to increased electricity consumption as trains operate inefficiently, potentially increasing CO_2, SO_2, NO_x, PM and mercury from coal-fired power plants. • In congested conditions, trains may rely more on their heating and cooling power systems for which may increase coal-powered electricity consumption and associated emissions. • A congested train system and increased train idling could contribute to urban heat islands which increases temperatures and promotes the formation of ground-level ozone.

No.	E&S Impact	Project Scenario		No Project Scenario	
		Positive Impacts	Adverse Impacts	Positive Impacts	Adverse Impacts
2	Noise	• Decongesting the train network in Almaty city can allow trains to maintain optimal speeds with less frequent stops and starts and idle less, possibly resulting in less mechanical noise generated from acceleration, braking and idling. • A less congested network in Almaty city may lead to fewer train passes and less noise generated.	• Heavy machinery and transport of materials using trucks during construction may contribute to noise pollution. • Earthworks, piling and drilling construction activities may increase noise levels. • Potential increase in noise levels from train horn blasts, engine and track noise during operations can adversely affect sensitive receptors. This is especially so at sensitive receptors unaffected by noise pollution prior to the Project.	• Absence of adverse impacts associated with the Project Scenario.	• A congested train system in Almaty city may have more trains starting, stopping and idling and may produce more track noise or continuous engine noise that can increase sound levels. • A higher train volume in Almaty city can lead to an increase in the frequency of train passes and affect nearby sensitive receptors. •
3	Vibration	• Decongesting the Almaty city train network may reduce the number of trains operating on the same track, smoother transitions and less abrupt stops and starts,	• Vibrations from trains can cause structural damage to buildings, particularly older or poorly constructed structures. • Repeated vibrations can lead to soil compaction, which may affect	• Absence of adverse impacts associated with the Project Scenario.	• A congested train system in Almaty city may lead to more frequent train passes and increase vibration levels and their associated impacts. •

No.	E&S Impact	Project Scenario		No Project Scenario	
		Positive Impacts	**Adverse Impacts**	**Positive Impacts**	**Adverse Impacts**
		reducing vibration levels. • A decongested network may result in better scheduling and spacing of train passes, which can reduce the vibrations experienced by sensitive receptors.	drainage, root growth for vegetation, and overall soil health. • Vibrations can disrupt local fauna habitats, potentially leading to changes in animal behaviour or displacement.		
4	Surface water quality	• Use of latest construction techniques may minimise migration of sedimentation and polluted surface runoff into adjacent water bodies. • Reclamation of temporary disturbed lands and slopes with plant species may prevent water and wind erosion.	• Construction of rail embankments may change the natural flow of surface water causing altered drainage patterns. • Soil erosion from construction activities can increase sedimentation in nearby waterbodies. • Surface runoff from railway lines may carry oils, heavy metals and chemicals from maintenance activities, and de-icing agents into the drainage system reducing surface water quality.	• Absence of adverse impacts associated with the Project Scenario.	• Continued potential contamination associated with the existing train networks in Almaty.

No.	E&S Impact	Project Scenario		No Project Scenario	
		Positive Impacts	**Adverse Impacts**	**Positive Impacts**	**Adverse Impacts**
			• Ballast leaching may release pollutants during rainfall or snowmelt.		
5	Soil quality	• Use of latest construction techniques may minimise migration of pollutants from the Project site onto adjacent lands.	• Construction activities and land clearance can disturb the natural soil structure, leading to increased erosion, especially in areas with slopes or loose soils.	• Absence of adverse impacts associated with the Project Scenario.	• Continued potential contamination associated with the existing train networks in Almaty.
6	Groundwater quality	• Use of latest construction techniques may minimise migration of pollutants from the Project site onto adjacent groundwater sources.	• Excavation activities may lower the groundwater table temporarily. Deeper excavations may lead to permanent dewatering and change the groundwater flow regime. • There is a potential quantity loss of groundwater as boreholes directly tap into the aquifer, which potentially altering its balance. • Construction of rail embankments may change the natural flow of groundwater and	• Absence of adverse impacts associated with the Project Scenario.	• Continued potential contamination associated with the existing train networks in Almaty.

No.	E&S Impact	Project Scenario		No Project Scenario	
		Positive Impacts	**Adverse Impacts**	**Positive Impacts**	**Adverse Impacts**
			causing altered drainage patterns.		
7	Biodiversity	• While no positive impacts are expected, adherence to EIA-recommended and supplementary mitigation measures can help manage and limit potential impacts to the immediate project footprint.	• Construction activities such as excavation, embankment creation, and vegetation clearing are expected to cause habitat loss and modification, potentially disrupting species composition, ecological connectivity, and local biodiversity. • Disturbances during construction, along with material and equipment movement, increase the risk of invasive alien species (IAS) introduction, which may outcompete native species and degrade ecosystems over time. • The operation of the railway bypass poses collision risks for terrestrial fauna, such as mammals and birds, and may lead to the entrapment of small	• Absence of adverse impacts associated with the Project Scenario.	• The present habitat has been degraded, with patches of relatively better-quality semi-desert, steppe grassland and riverine habitat remaining. In the absence of the project, continued high grazing pressures, which have already led to overgrazed areas and the spread of invasive alien species (IAS), would result in further degradation of the available habitat, particularly the remaining higher-quality patches. Ongoing anthropogenic pressures would exacerbate habitat degradation and facilitate the continued proliferation of IAS over time.

No.	E&S Impact	Project Scenario		No Project Scenario	
		Positive Impacts	Adverse Impacts	Positive Impacts	Adverse Impacts
			species, causing localised mortality. • Operational activities may cause minor habitat fragmentation, disrupt species movement, and create barriers, while light, noise, and vibration impacts are expected to influence species behaviour and habitat use locally.		
8	Land use and ownership	• Changing the land use from mainly agriculture and peasant farming to accommodate a railway line expansion, with three new stations, might increase the value of the land for the surrounding communities.	• Physical and economic displacement due to land acquisition. • Disruption of household and community activities. • Income and livelihood impact due to access disruption and land fragmentation. • Temporary loss of income for land lease holders, tenant farmers and workers who are affected by land acquisition	• No disruption of household and community activities • No income and livelihood impact and physical and economic displacement.	• Absence of adverse impacts associated with the No Project Scenario.
9	Labour and working conditions	• Increased employment opportunities for nearby communities.	• Occupational health and safety risks for workers	-	• Less employment opportunity for workers

No.	E&S Impact	Project Scenario		No Project Scenario	
		Positive Impacts	Adverse Impacts	Positive Impacts	Adverse Impacts
		• Indirect economic opportunities through rail activity • Capacity Building for Workforce	during the construction phase. • Living and working conditions at workers' accommodation during the construction phase. • Occupational health and safety risks for workers during the operational phase.		and nearby communities.
10	Community Health and Safety	• Adherence to EIA-recommended and supplementary mitigation measures can help manage and limit potential impacts to the immediate project footprint.	• Construction Phase: • Nuisance due to construction dust and noise- potentially affecting the resident population, agricultural fields and livestock (especially those grazing in the vicinity of the construction works). • Increased risk of traffic accidents, loss of livestock and loss of life due to construction vehicles. • Construction vehicles causing damage to land when used as access roads. • Presence of security personnel leading to risk	• No construction or operations risks to community health and safety envisaged.	• -

No.	E&S Impact	Project Scenario		No Project Scenario	
		Positive Impacts	Adverse Impacts	Positive Impacts	Adverse Impacts
			of conflict with the local communities • Increased risk of Sexual exploitation and abuse (SEA) and Gender based violence and harassment (GBVH), especially among the young and women, from the local communities. • Public and social infrastructure strain. • Disease spread due to influx of labour force from outside • Operation Phase: • Increased risk of traffic accidents, loss of livestock and loss of life due to increased rail activity and traffic. • Increased strain on public and social infrastructure.		
11	Socioeconomic Conditions	• Construction Phase: • Direct employment opportunities due to the Project • Economic opportunities created through local procurement.	• Loss of income and livelihood restoration if compensation at full replacement cost (as per LRP and IFC PS5 recommendation) is note adhered to.		• Continued congestion in Almaty City and lack of new employment opportunities for the construction of the Bypass.

No.	E&S Impact	Project Scenario		No Project Scenario	
		Positive Impacts	Adverse Impacts	Positive Impacts	Adverse Impacts
		• Capacity building for local construction workers, subcontractors and suppliers. • Indirect employment and economic opportunities created through presence of workers. • Operations Phase: • Opportunities for direct employment in railway operations. • Indirect opportunities created through opportunities created by rail activity e.g. small businesses. • National and regional economic growth due to increased freight volume and associated government revenue through taxation. • Increased accessibility for passenger and cargo transport.			
12	Transport systems	• Increased freight and passenger train frequency outside Almaty city that may	• Construction may cause temporary disruptions to existing transport	• Absence of adverse impacts associated with the Project Scenario.	• Congestion leads to longer wait times for trains, resulting in

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">E&S Impact</th><th colspan="2">Project Scenario</th><th colspan="2">No Project Scenario</th></tr>
<tr><th>Positive Impacts</th><th>Adverse Impacts</th><th>Positive Impacts</th><th>Adverse Impacts</th></tr>
<tr><td></td><td></td><td>increase overall capacity of the transport network and reduce delays.
• Will improve travel times and reliability for freight and passenger services, enhancing the overall efficiency of the transport system.
• Additional routes and connections provided, improving access to different regions.</td><td>systems including road closures or detours.
• May cause competition of resources such as funding and staff between the new and existing rail services.</td><td></td><td>delays for passengers and freight.
• Inefficient use of infrastructure may limit the overall capacity of the transport system.
• Potential delays in cargo delivery may can disrupt supply chains.
• As rail services become less reliable due to congestion, passengers and freight may shift to road transport, leading to increased road traffic congestion and associated emissions.</td></tr>
</table>

2.5.2 ALTERNATIVE DESIGN

2.5.2.1 LAYOUTS AND ROUTES

The four (4) alternative routes for the railway bypass were considered are summarised below from the 2023 Operational Design (Ref. 754189/2022/1-OPZ) and shown in **Figure 2-4**.

- **Option 1**: According to the 2012 Feasibility Study, the proposed route traverses the segment from KM 0 to 15 through the terrain of the Tian Shan foothills. This area features a hilly landscape with elevations ranging from 50m to 90m, and it is characterised by numerous erosion cuts with log erosion barriers with depths varying from 5m to 15m. From KM 15 to 35, the route runs along the Mezhdurechensk site, situated near the settlements of Mezhdurechensk, Karaoi, and Chelikimir, and crosses a dense network of irrigation canals. From KM 35 to 1,644, the route aligns with the existing Aktogay to Almaty railway track. This section passes through residential (dacha) areas and runs between the villages of Zhanalyk and Zhana Arna, ultimately connecting to the existing Almaty - Aktogay railway at the Kairat - Zhetygen Station segment. Due to the terrain challenges and hydrological constraints, this option is not the best possible option.
- **Option 2**: The proposed route connects to the Zhetygen and Kurkuduk stations. From KM 0 to 15, the route mainly passes in the direction planned according to the feasibility study. From KM 15 to 24, the route crosses two highways, necessitating the construction of railway overpasses, as well as several irrigation canals, before proceeding into the sandy areas of Moyinkum that would pose engineering challenges for the railway. Between KM 15 to 40, the railway line would have to bypass existing developments. From KM 40 to the Zhetygen-Kairat section, the route intersects with the Almaty-Kapshagay and Almaty-Zhetygen highways, requiring overpasses to be constructed. The alignment avoids the existing structures in the village of Zhana Arna and crosses an existing road at KM 1,644. The route would have approached the Zhetygen Station via a new second track on a shared roadbed with the existing railway. This alignment is not idea as it faces major engineering, financial, and environmental challenges due to multiple highway crossings, sandy terrain, and the need to navigate around existing developments.
- **Option 3**: In accordance with the General Plan for the suburban zone of the city of Almaty, the route was refined to comply with the railway transport standards required, specifically regarding corner entrances at junction stations and ensuring that the line fits the terrain with the specified guiding slope. This option was deemed inadmissible by KTZ after discussions with no further explanation provided.
- **Option 4**: This route starts from the existing Kazybek Bek Station and follows the shortest possible path route towards Zhetygen Station, while avoiding the Ministry of Defense's tank drome and the National Security Committee’s (NSC) training grounds. Per the National EIA, it is understood that Option 4 contained sub-options. However, only information on sub-option 4.3 was made available for assessment.
    - Sub-option 4.3: The route runs along the edge of a hilly ridge and passes through a valley near the Ministry of Internal Affairs. The route avoids the NSC facility and descends to the Kaskelen River along the boundary of the NSC training grounds. The route partially traverses section No. 208-005 of the Ministry of Defense and crosses the river via a bridge. Beyond this point, the route is aligned with Option 4. An advantage of sub-option 4.3 is that it requires the least amount of earthworks

compared to other options that connect at the same points. However, a disadvantage is the inability to traverse through the sandy areas of Moyinkum while avoiding all land plots controlled by the Ministry of Defense and the NSC.

- **Option 5**: Final Project Alignment

Option 5, the Project alignment shown in **Figure 2-2** was selected for implementation. In determining the final alignment, the appraisal process included the following considerations:

(i) Community and Social Impacts

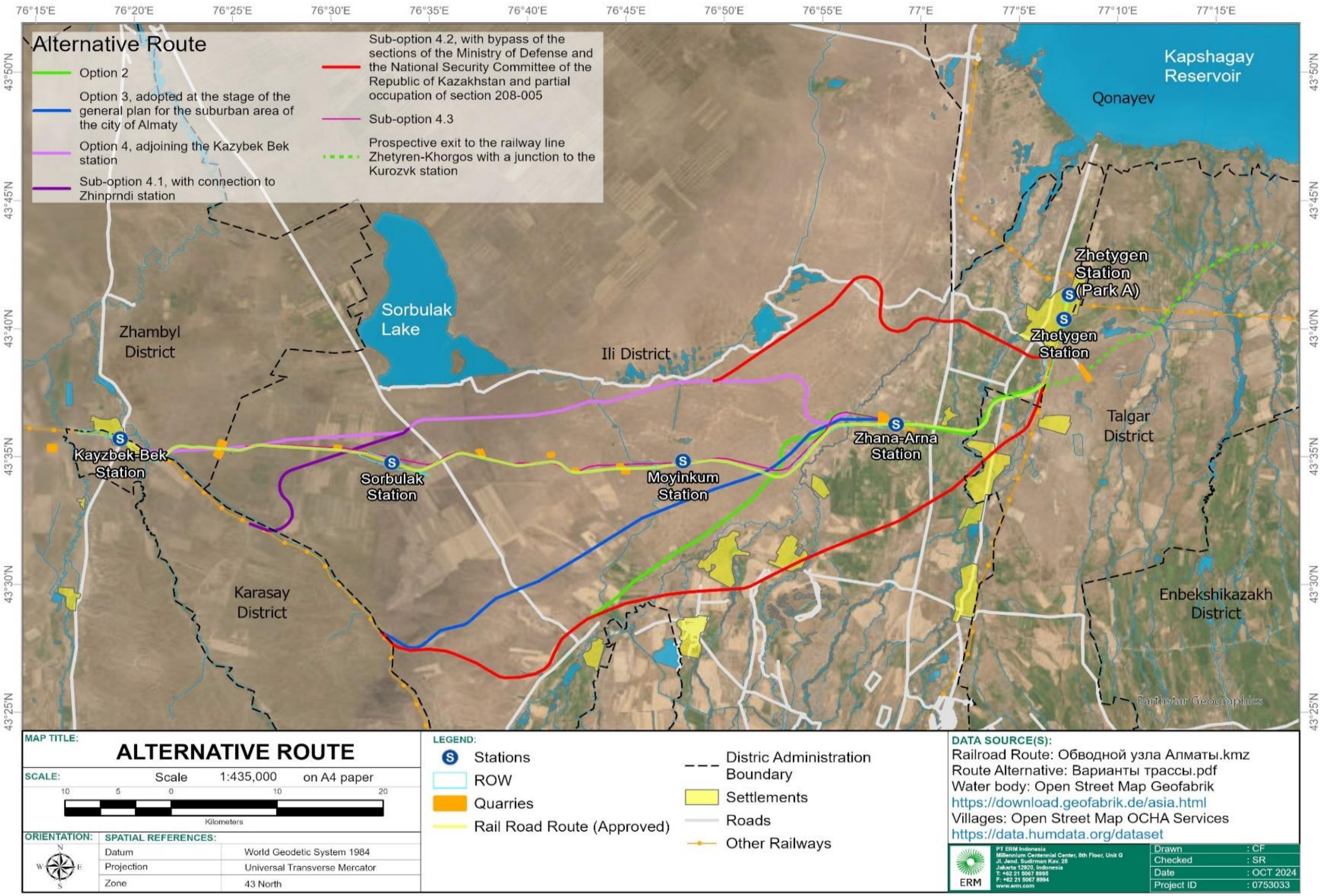
- Reduced disruptions to populated areas and existing settlements.
- Minimised earthworks to protect livelihoods.
- Aligned with Almaty's General Plan for suburban zones to limit land use conflicts.
- Ongoing conversations with local Land Departments to minimise resettlement and physical displacement, especially at Zhetygen station.

(ii) Environmental Impacts

- Avoidance of crossings over ecologically important areas to avoid habitat loss and disruptions.
- Observations on site suggested that water bodies were largely avoided in the design of the alignment, avoiding potential impacts to hydrology.

Comparing the alignment options with the available information, the final alignment decision considered potential environmental and social impacts in addition to the Project's technical feasibility and commercial viability.

FIGURE 2-4: ALTERNATIVE RAILWAY ROUTES



3. APPLICABLE REFERENCE FRAMEWORKS

3.1 NATIONAL LEGISLATION OF THE REPUBLIC OF KAZAKHSTAN (ROK)

Table 3-1 below provides a summary of the RoK legislation relevant to this Project that has been considered in the Supplementary ESIA Report. It should be acknowledged that this is not exhaustive and further legislation and regulatory measures are provided within each assessment.

TABLE 3-1: REPUBLIC OF KAZAKHSTAN LEGISLATION

Title	Year
The Republic of Kazakhstan Constitution	2022
Environmental Code of the Republic of Kazakhstan	2021
Labour Code of the Republic of Kazakhstan	2015
Law on State Property (#413-IV LRK adopted on 1 March 2011, last amendment dated 21 May 2024 to be enforced on 22 July 2024)	2011
The Land Code (RK Code #442-II, adopted 20 June 2003, with last amendment on 21 May 2024)	2003
Labour Code (№ 414-V, adopted on 23 November 2015, last amendment dated 15 April 2024 to be enforced on 16 June 2024)	2015
The Law of the Republic of Kazakhstan on architectural, urban planning and construction activities in the Republic of Kazakhstan (#242-II adopted on 16 July 2001, last amendment 21 May 2024 to be enforced on 22 July 2024)	2001
Law on Protection and Use of Objects of Historical and Cultural Heritage of the Republic of Kazakhstan No. 1488-XII (1992, as amended by No. 288-VI, 2019)	1992
The Law on Public Procurement (No. 434-V 3PK adopted 4 December 2015, last amendment dated 29 December 2018)	2015
The Law of the Republic of Kazakhstan on the Electric Power Industry (#588-II dated 9 July 2004)	2004

3.1.1 ENVIRONMENTAL APPROVALS

The project design was developed by Poligram LLP, a design organisation based in Atyrau, Kazakhstan. The design **has received formal approval**, as indicated by the conclusion with reference number **01-0471/23**, dated 20 November 2023. This conclusion was issued by the Republican State Enterprise (RSE) "GOS Expertiza", which is the Kazakh government agency responsible for expert evaluation and approval of project documentation to ensure it meets safety, environmental, and regulatory standards. This approval allows construction to proceed according to the submitted designs.

The local environmental review process for the project has been completed, and the project has received approval for implementation, subject to compliance with specific conditions outlined in Letter No. **KZ35VVX00286500 (20 February 2024)**. The conditions set out in the letter were regarding waste management, biodiversity and soil and have been considered as embedded controls in the National EIA (InTech, 2023). This letter was issued by the Branch of JSC "National Company 'Kazakhstan Temir Zholy'" - "Directorate for the Implementation of Major Projects," and confirms that the EIA process has been conducted in accordance with the Environmental Code of the Republic of Kazakhstan. This includes screening, preparation of impact reports, and public hearings held on 29 and 30 January 2024.

The project is classified under Category II of environmentally impactful activities, indicating moderate environmental risks, and the provided conditions ensure compliance with the Code’s requirements on waste management, water protection, land reclamation, and wildlife preservation. Refer to **Section 3.2** for the project permitting status.

3.1.2 PUBLIC CONSULTATION

In Kazakhstan, the Ministry of Information and Communications oversees the enforcement of the Law on Access to Information and the dissemination of government information. Meanwhile, the Ministry of Social Development is responsible for facilitating opportunities for stakeholder engagement and assisting the activities of Public Councils. The key public consultation regulations are presented in **Table 3-2**.

TABLE 3-2: PUBLIC CONSULTATION REGULATIONS

National Legal Requirements	Year
Law of the Republic of Kazakhstan “On Access to Information”, dated 16 November 2015 No. 401-V	2015
Law of the Republic of Kazakhstan “On Public Councils” (as amended on 27 February 2017)	2017
The Ecological Code of Kazakhstan (#400-VI, adopted 2 January 2021, with the last amendment on May 21, 2024)	2024

Below is a list of the laws related to promoting public consultation:

1. Law of the Republic of Kazakhstan “On Access to Information”

The Law of the Republic of Kazakhstan on Access to Information emphasizes promoting transparency and public access to governmental information. It outlines the establishment of various online platforms, including an Open Data Portal, an Open Dialogue Portal for public interaction with officials, and a portal for Normative Legal Acts where draft regulations can be discussed before approval. Information holders are required to make information about their activities readily accessible, including budget reports and the results of audits. Additionally, the law mandates that meetings of governmental bodies be open to the public and ensures accessibility for individuals with disabilities. Overall, the law aims to enhance public engagement and accountability in government operations.

2. Law of the Republic of Kazakhstan “On Public Councils”

The essence of the Law on Public Councils in Kazakhstan is to establish a framework for creating and regulating public councils at both the republican and local levels. These councils are intended to facilitate public participation in governance and enhance accountability and transparency within government bodies. The purpose of this law is mainly to enhance the transparency of the process and content of lawmaking by providing requirements for the procedure of making draft legal acts public and accessible for public comments:

- “Ensure and increase the transparency with regard to public and stakeholders’ participation in policy and decision making processes of public bodies,

- Fulfilling the objectives of good, transparent and inclusive governance in the decision-making processes."

Articles 16-19 outline the procedures for public councils in the form of "public control". The various forms of public control are defined as follows:

1. **Public Expertise**: This refers to the process of evaluating draft normative acts to ensure they align with public interests.
2. **Public Monitoring**: This involves the oversight of state activities conducted by public councils, non-profit organisations, and citizens acting on behalf of the public councils.
3. **Public Hearings**: These are forums for discussing important issues and decisions made by state bodies, focusing on their alignment with public interests.
4. **Review of State Bodies' Reports**: This entails a public discussion within the Public Council regarding the outcomes of the activities of state and local self-government bodies.

3. The Ecological Code of Kazakhstan

The Ecological Code of Kazakhstan (#400-VI, adopted 2 January 2021, with the last amendment on 21 May 2024) sets the legal framework for environmental protection and includes provisions for public hearings related to environmental expertise.

- **Purpose of Public Hearings**: While public hearings are not directly part of the land acquisition process, they provide affected individuals with opportunities to understand project details, raise concerns about impacts on their property, and learn about mitigation measures.
- **Draft Report**: Article 73 requires that a draft report on potential impacts be submitted for public hearings before assessment by the environmental protection authority.
- **Organisation of Hearings**: The hearings must follow guidelines from the Minister of Ecology, including:
    - The draft report must be accessible online for at least thirty days.
    - Announcements must be published in local newspapers and broadcasted on TV or radio in both Kazakh and Russian at least twenty working days before the hearings.
- **Public Participation**: Government bodies and the public can submit comments in writing or express them orally during the hearings. Participation is open to anyone, regardless of residence.
- **Post-Hearing Protocol**: After the hearings, a protocol is created documenting all comments, responses from the project initiator, and any follow-up consultations if necessary. This protocol excludes any comments that were withdrawn during the hearings.

3.1.3 LAND ACQUISITION

The Project's land procurement considers (i) the Project's land requirement, and (ii) the Project's Right of Way (RoW) as regulated by national laws. The Law of the Republic of Kazakhstan on Railway Transport establishes 'protective zones' around railway infrastructure to ensure the safety, operational integrity, and durability of rail transport. These zones regulate activities near railway tracks, safeguarding public safety and preventing disruptions to railway operations. Specific restrictions apply to construction, land use, and other activities within these designated zones.

- The Project footprint includes a 30m-wide rail track;
- A 100m right of way (RoW) on both sides of the track; and
- The Project's OHTLs will run parallel to the alignment through a 10kV low voltage transmission line which is to be located underground and within the right of way.

Easement right for the OHTL connecting the existing PS-Alma 500kV substation to the proposed Zhana Arna substation through an approximate 1.9km 200kV OHTL, of which 500m is within the RoW[39]. ERM has based the land requirements and RoW of the Project on information provided by KTZ.

In Kazakhstan, land ownership resides with the State, which has the authority to transfer, sell, or lease it to individuals or legal entities. Most leases are typically long-term, lasting around 49 years, while some individuals or organisations may opt for shorter leases that range from 1 to 5 years. The State is permitted to reclaim privately owned land only for designated purposes, such as railroad construction (refer to Land Code, Article 84.2.4), and must provide compensation to the landowner for their property and any related losses (refer to Land Code, Article 166).

Land acquisition for state purposes, including compulsory acquisition for state projects like railway development, is categorised as an "exceptional circumstance" (refer to Land Code, Article 84), is undertaken as per the Land Code "Article 84: Expropriation of land for public and state use". Article 84.1 states that the plot may be forcibly alienated for state needs by the court if there is no other way to reach an agreement between the owner and the court.

Land Acquisition on Private Land

The land acquisition for private land typically adheres to the following procedures:

1. **Initial Request:** Following an agreed alignment with local officials, the agency needing the land requests the relevant Akimat to issue a resolution for land acquisition.
2. **Akimat Resolution:** The Akimat issues a resolution for the land acquisition and registers it with the Oblast Department of Justice, with notifications sent to property owners regarding the extent of acquisition.
3. **Valuation:** Licensed valuators are engaged by the Akimat to determine official compensation amounts for the affected properties.
4. **Negotiation:** After establishing compensation amounts, negotiations between the government and affected parties commence. Signed agreements are registered with the "Government for Citizens" State Corporation in Almaty Region, and compensation amounts are processed for payment to affected individuals.
5. **Court Appeal:** If no agreement is reached, the government may initiate a court appeal for expropriation after three months from the notification date to the owner.

[39] As of 20 January 2025, the acquisition process for the land required for the OHTL has not yet begun. KTZ has yet to obtain information on the type of land ownership and land use. KTZ's design consultant Poligram has confirmed that the OHTL is 1.961km, with some overlap with the project alignment's RoW (estimated about 500m). The land to be acquired, according to KTZ, will be 1m x 1m for each transmission tower, with an estimated 17-19 towers required.

6. **Court Decision:** Following a court decision, the compensation will be transferred to the affected land user's account. Access to the land cannot be granted until compensation is paid, and ownership title is transferred.
7. **Financing and Payment:** Funds for compensation are allocated, with payments required within one month after the court ruling becomes final or after the signing of the land acquisition agreement.

Land Acquisition on Leased Land

Article 84.4 states that, the expropriation of land for public use for those under leased land, shall be without compensation of land use rights. It further stresses that land users will be reimbursed of the losses in full, and at their request may be granted another land.

Land Acquisition on State Land

The land acquisition process from state land for public use (refer to Land Code, Article 89), follows the principle that the seizure of land from state land for public needs is based on a "unilateral decision by the executive body which carries out the removal. Such a decision may be appealed to a higher authority or by the courts, and filing an appeal suspends the execution of the decision on seizure.

A detailed overview of the land acquisition process and the key national legal requirements are presented in the Livelihood Restoration Plan. **Table 3-3** lists of key national legal requirements related to land acquisition and/or affected by projects where land acquisition is required (such as cultural heritage laws). Refer to the LRP for a further breakdown of the national legal requirements.

TABLE 3-3: LAND ACQUISITION REGULATIONS

National Legal Requirements	Year
The Land Code (RK Code #442-II, adopted 20 June 2003, with last amendment on 21 May 2024)	2024
Law on State Property (#413-IV LRK adopted on 1 March 2011, last amendment dated 21 May 2024 to be enforced on 22 July 2024)	2024
The Law on Housing Relations (№ 94-I, adopted on 16 April 1997, last amendment dated 21 May 2024 to be enforced on 22 July 2024)	2024
Labour Code (№ 414-V, adopted on 23 November 2015, last amendment dated 15 April 2024 to be enforced on 16 June 2024)	2024
The Law of the Republic of Kazakhstan on Railway Transport (#266-II adopted on 8 December 2001, last amendment dated 19 April 2023)	2023
The Law of the Republic of Kazakhstan on State Administration and Local Self-Government (#148 adopted on 23 January 2001, last amendment dated 21 May 2024 to be enforced on 22 July 2024)	2024

National Legal Requirements	Year
Civil Code (General Part) of the Republic of Kazakhstan (adopted on 27 December 1994, last amendment dated 12 July 2022)	2022
The Law of the Republic of Kazakhstan on architectural, urban planning and construction activities in the Republic of Kazakhstan (#242-II adopted on 16 July 2001, last amendment 21 May 2024 to be enforced on 22 July 2024)	2024
The Law of the Republic of Kazakhstan "On appraisal activity in the Republic of Kazakhstan" #133-VI adopted 10 January 2018, last amendment 31 December 2021)	2021
Ecological Code of the Republic of Kazakhstan (# 400-VI adopted on 2 January 2021, last amendment dated 21 May 2024 to be enforced on 22 July 2024)	2024
Law of the Republic of Kazakhstan "On the protection and use of historical and cultural heritage sites" dated 26 December 2019 № 288-VI	2019

3.2 PROJECT PERMITTING STATUS

In accordance with the Lenders' requirements the Project must comply with the requirements of the national legislation. The permitting status of the Project is presented in **Table 3-4**.

TABLE 3-4: KEY E&S PERMITTING STATUS

Permit	Status
Permission for the construction of the Almaty Bypass Project (based on the approval of the Kazakhstan EIA)	**Approved** Document Reference: • Committee for Environmental Regulation and Control, Ref. KZ35VVX00286500 dated 20 February 2024 approved the National EIA. • State Non-Departmental Examination of Projects RSE "GOS Expertiza", Ref. 01-0471/23 dated 20 November 2023, approved the construction of the Project. • State Institution of the Almaty Region Passenger Transport and Automobile Roads Management, Ref. 01-24-07/1031 dated 14 July 2023, indicated the Project's design and construction has met regulatory requirements. • Department of Roads and Construction, Ref. CP/18426-I dated 18 August 2023, approved the Project's design and construction. • QazAvtoJol Almaty Branch Ref. 18-01/18-02/1643-I dated 6 September 2023, approved the Project and construction. • Balkhash-Alakol Basin Inspectorate for the regulation of the use and protection of water resources No. KZ96VRC00017833 dated 24 October 2023, approved

Permit		Status
		the Project and conditions of construction on water bodies, water protection zones and strips.
Permission for the use of subsurface resources: quarry/borrow areas		**Approved** Document reference: State Institution "Department of Entrepreneurship and Industrial and Innovative Development of Almaty Region", Ref. DDM/1588-2024 from 16 October 2024.
Permission for the use of subsurface resources: groundwater wells for construction activities and construction camp		**Informal Agreement**[40] Approved permits for groundwater usage for construction is unavailable at the time of writing.
Approval for connection to the water supply network (drinking water)		**Informal Agreement**[41] Approved permits for use of drinking water supply for the Project are unavailable at the time of writing.
Approvals and permissions for utilities use / transfer	Power	**Power: Approved** **Gas, water and sewerage: Approved according to KTZ** Document Reference: • Kazakhstan Electricity Grid Operating Company JSC (KEGOC) Ref. 01-09-08/7262 dated 23 October 2023 approved the Project. • Gas, water and sewerage approval permits were unavailable for review at the time of writing.
	Gas	
	Water	
	Sewerage	

3.3 INTERNATIONAL STANDARDS

The Supplementary ESIA Report is developed in accordance with the following applicable reference framework:

- The Project will be structured to meet relevant environmental and social standards, including (but not limited to) the pertinent requirements of:
  - Applicable national E&S regulations for linear infrastructure projects.
  - International Finance Corporation (IFC) Performance Standards (PS) (2012).
  - WBG General EHS Guidelines EHS (2007).
  - WBG EHS Guidelines for Railways (2007).
  - WBG EHS Guidelines for Electric Power Transmission and Distribution (2007).
  - WBG EHS Guidelines for Construction Materials Extraction (2007).

[40] Based on site clarifications during the site visit in January 2025, Poligram confirmed that groundwater well agreements are done between subcontractors and households for the use of well when needed, and thus, these agreements tend to be informal and not written.
[41] Based on site clarifications during the site visit in January 2025, Poligram confirmed that underground water agreements to use household wells are done between subcontractors and households for the use of well when needed, and thus, these agreements tend to be informal and not written.

  - IFC Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (2013).
  - IFC Good Practice Note: Managing Contractors' Environmental and Social Performance (2017).
  - All ILO conventions signed and ratified by Kazakhstan, all ILO conventions covering core Labour standards and all ILO conventions covering the basic terms and conditions of employment.
  - IFC / EBRD Guidance on Worker Accommodation (2009).
- The Project shall include all reasonable measures to avoid, minimise or mitigate any adverse changes in environmental and social conditions, and impacts on public health and safety, especially with respect to any disproportionate impacts on any group of people because of their gender, age, ethnicity, disability, socio-economic status and/or other personal characteristics.
- It will consider relevant international conventions and protocols relating to environmental and social issues, as transposed into national legislation. Discipline specific legislation and policy requirements are outlined within each subsection.

3.3.1 PROJECT CATEGORISATION

As part of a review of the environmental and social impacts of a proposed investment, projects are categorised as A, B, C or FI to determine the nature and level of environmental and social investigations, information disclosure and stakeholder engagement required. This will be commensurate with the nature, location, sensitivity and scale of the project, and the significance of its potential adverse future environmental and social impacts. Past and present environmental and social issues and risks associated with project-related existing facilities will be subject to environmental and social appraisal regardless of the categorisation.

3.3.2 PERFORMANCE REQUIREMENTS

The environmental and social safeguard policy of IFC is defined by the performance standards (PSs). A brief description of PSs and their applicability to this Project are discussed in **Table 3-5**.

TABLE 3-5: APPLICABILITY OF IFC PERFORMANCE STANDARDS TO THE PROJECT

IFC Performance Standards	Applicability to Project	Remarks
PS1: Assessment and Management of Environmental and Social Risks and Impacts.	Applicable.	The National EIA conducted as part of the infrastructure permitting process categorized the Project as Category II, assessing the Project to have a moderate negative impact on the environment. The National EIA did not assess any potential social impacts related to the Project. This Supplementary ESIA is prepared in compliance with IFC guidelines to address key environmental and social (E&S) impacts. A defined Project-level

IFC Performance Standards	Applicability to Project	Remarks
		mechanism for the assessment and management of E&S impacts is detailed in the ESMP.
PS2: Labour and Working Conditions	Applicable.	Labour workforce of 1,400 will be engaged for the peak construction with construction camps provided for the local workforce residing outside of the Almaty region. An operational and maintenance workforce of 500 is forecasted.
PS3: Resource Efficiency and Pollution Prevention	Applicable.	Construction and operation of the Project includes the generation of dust, noise emissions, usage of groundwater, soil extraction and discharge and management of wastewater and waste.
PS4: Community Health, Safety, and Security	Applicable.	Due to the extent of the rail alignment and proximity to settlements and villages, particularly at Kazybek Bek and Zhetygen Station, impacts to nearby communities includes the noise and air emissions from the construction and operational activities and the interactions between the affected persons and stakeholders with security personnel associated with the railway and stations, as well as the transport of construction materials.
PS5: Land Acquisition and Involuntary Resettlement	Applicable.	The Project has procured a mix of private, company, and government land. Negotiations began as early as May 2023 when District Akimats issued Decrees identifying the land plots needed for acquisition. Formalisation of land acquisition is still in process for various parcels of land. A Livelihood Restoration Plan (LRP) is prepared as part of this Supplementary ESIA.
PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Applicable.	The Project alignment overlaps with areas of natural habitat including riparian habitat, steppe grassland habitat and a mix of riparian/steppe. The Project will require vegetation clearance which leads to direct loss and alteration of habitats.
PS7: Indigenous Peoples	Not Applicable.	Based on a review of the National EIA and consultations with the District Akimats, no Indigenous People are located within the Projects AoI.
PS8: Cultural Heritage	Limited Applicability.	Three cultural heritage sites are located outside of a 120m distance from the centreline of the alignment. These are located outside the corridor RoW however, are within the Project AoI.

3.3.3 INTERNATIONAL CONVENTIONS

The following international conventions and agreements signed and ratified by the Republic of Kazakhstan are applicable to the Project (**Table 3-6**).

TABLE 3-6: APPLICABLE INTERNATIONAL CONVENTIONS AND AGREEMENTS SIGNED AND RATIFIED BY THE REPUBLIC OF KAZAKHSTAN

Title	Date and place of signature	Comments on the applicability to the Project and summary of the requirements
Climate and Air		
UN framework convention on climate change	1992, Rio de Janeiro	The Client will evaluate predicted GHG emissions and provide for avoidance or mitigation of adverse effects.
Vienna Convention for the Protection of the Ozone Layer and Montreal Protocol on Substances that Deplete the Ozone Layer	1985, Vienna 1987, Montreal	The Project must not result in "adverse effects resulting or likely to result from human activities which modify or are likely to modify the ozone layer".
Convention on Long-range Transboundary Air Pollution	1979, Geneva	The Project design must provide for measures to limit and, as far as possible, reduce air pollution including long-range transboundary air pollution.
Flora and Fauna		
Convention on Biological Diversity	1992, Rio de Janeiro	The Project must be implemented with due regard to the following principles: • Conservation of biodiversity • Sustainable biodiversity use/management • Equitable sharing of the benefits from the use of genetic resources
Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	1979, Bonn	The Project must be implemented with due regard to the principle of conservation of migratory species of wild animals and their habitats.
Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention)	1971, Ramsar	The Client will establish if any ecosystems covered by this Convention exist within the Project or in the immediate proximity to the project facilities and will take the adequate protection/conservation measures if required.
Land		
UN Convention to Combat Desertification/ Land Degradation	1994, Paris	The Client will provide for measures to improve productivity of land, and the rehabilitation, conservation and sustainable management of land and water resources.
Cultural Heritage		
Convention concerning the Protection of the World Cultural and Natural Heritage	1972, Paris	The Client will identify whether objects of cultural and natural heritage covered by this Convention exist within immediate proximity to the project facilities and will take the adequate protection/conservation measures if required.

Title	Date and place of signature	Comments on the applicability to the Project and summary of the requirements
Social Aspects / Consultations		
Convention on Access to Information, Public Participation in Decision making and Access to Justice in Environmental Matters	1998, Aarhus	The Client will provide for: • Access to the Project information; • Public participation in decision-making; and • Access to justice in environmental matters.
Gender		
ILO C190 - Violence and Harassment in the World of Work	2019, Geneva	The project will take preventative measures, establish clear complaint mechanisms, and take corrective actions if needed.
Health and Safety		
ILO C148 – Working Environment (Air Pollution, Noise and Vibration) Convention	1977, Geneva	The Project/Client will provide for measures for the prevention and control of, and protection against, occupational hazards in the working environment due to air pollution, noise and vibration.
ILO C155 – Occupational Safety and Health Convention	1981, Geneva	The Project will provide for measures to prevent accidents and injury to health arising out of, linked with or occurring in the course of work, by minimising, so far as is reasonably practicable, the causes of hazards inherent in the working environment.
ILO Conventions 29 and 105 (Forced or Compulsory Labour), 87 (Freedom of Association), 98 (Right to Organise and Collective Bargaining), 100 and 111 (Discrimination), 138 (Minimum Age), 182 (Worst Forms of Child Labour), and 190 (Violence and Harassment)	-	The Project/Client will provide for measures to prevent discrimination, forced or compulsory labour, or child labour.
Convention on Road Traffic	1968, Vienna	The Project will facilitate international road traffic and increase road safety through the adoption of uniform traffic rules.
Convention on Road Signs and Signals	1968, Geneva	The Project will uniformity of road signs, signals and symbols and of road markings is necessary to facilitate international road traffic and to increase road safety.
European Agreement concerning the work of Crews of Vehicles engaged in	1970, Geneva	The Project will reduce road accidents due to fatigue, uniform working conditions.

Title	Date and place of signature	Comments on the applicability to the Project and summary of the requirements
International Road Transport (AETR)		

4. OVERVIEW OF STAKEHOLDER ENGAGEMENT

4.1 INTRODUCTION

This section provides a summary of the stakeholder engagement activities undertaken from an early stage of the Project based on the information available at the time of writing, and during the Supplementary ESIA. As the Project was publicly announced in 2012, there may be additional stakeholder engagements that were conducted in addition to those documented below. ERM will develop a Stakeholder Engagement Plan (SEP) and Grievance Redressal Mechanism (GRM) for the project. A draft SEP was developed at the scoping stage. This has been further developed as part of the Supplementary ESIA report. The SEP will include a summary of the key outcomes from the discussions with the stakeholders highlighting further engagement opportunities across the Project life cycle.

4.2 STAKEHOLDER ENGAGEMENT HISTORY

4.2.1 FROM 2012 TO 2023

Overall Public Engagements

Through consultations with KTZ, it is understood that landowners in the area of influence were aware of potential land acquisition since 2012 when the Project was first announced[42]. However, since the initial conceptualization of the project, various design options were considered, with four main options that would have had different socio-economic implications, as outlined in **Section 2.5.**

The construction of the Almaty Bypass was formally announced by the Kazakh government, through the Minister of Industry and Infrastructure Development, Kairbek Uskenbayev, in March 2022.

Cultural Heritage Engagements

In 2014, Margulan was engaged as a Cultural Heritage consultant to conduct expert studies on the identification of objects of cultural and historical significance in the area. The studies concluded that there were three (3) objects of significant cultural heritage such as burial mounds of the Iron Age. However, no coordinates of the three (3) objects were stated in the letter, and no information on which option of the alignment the study was conducted in relation to. The letter broadly states that the proposed route of the bypass railway line is near Almaty M1:25 000.

On 27 March 2023, a historical-cultural study was conducted by Antique-KZ. The study concluded that there was historical-cultural heritage site consisting of over ten (10) mounds and five (5) small ritual sites identified in the area. The study, which was included in the National EIA, has been excluded from the Supplementary ESIA based discussions with the Project Proponent regarding inconsistencies that calls into question its accuracy and reliability.

[42] IFC's Kazakhstan Almaty Railway Bypass Project, Pre-Concept Mission, 15 - 19 April 2024, Back to Office Report.

On 29 October 2024, in a letter No 54/20-480 written by Margulan to KTZ, Margulan concluded that there were no historical or cultural heritage objects the 240m Cultural Heritage (CH) survey corridor (120m from either side of the railway centreline).

4.2.2 BETWEEN MAY 2023 – SEPTEMBER 2024

Information of the following engagements pertaining to the public hearings was extracted from the minutes of the hearings made available to ERM, and information pertaining to the process of land acquisition was summarized based on the IFC Land Acquisition Gap Analysis Report, authored by an independent Consultant, and with the final version submitted on 5 September 2024.

Official Public Announcement

The construction of the railway officially commenced on 14 November 2023, when the Government of the Republic of Kazakhstan, led by Prime Minister, announced the initiation of the Almaty Bypass project. On 15 November 2023, the construction of the Almaty Bypass was officially issued online by KTZ[43].

The Project, part of a larger railway network and strategy by KTZ, has also been broadcasted by international financial institutions, such as the Multilateral Investment Guarantee Agency (MIGA) and by the World Bank[44].

Public Hearings

On 27 December 2023, a regional public hearing meeting for the National EIA occurred, with a subsequent meeting for the approval of the National EIA on 30 January 2024. 12 local residents representing local villages attended.

Based on the meeting minutes representatives from InTech and Poligram attended the hearings and presented the Project details, key environmental considerations and possible impacts and addressed the questions posed by audience members.

From January - April 2024 several public consultations led by KTZ, representatives from the Contractors (InTech and Poligram) and District Akimat representatives took place. Each public consultation had a different representation of stakeholders. Details about the public consultation were communicated in both Kazakh and Russian via the Unified Environmental Portal, the official website of the local executive authority, or the state body responsible for the development (https://ecoportal.kz/) Details of the public hearings include:

- **29 January 2024 in Zhambyl District:** The outcome of the meeting indicated strong support for the proposed project, with 31 participants in favour, and none against or abstaining from the vote.
- **30 January 2024 in Iliy District:** The outcome of the meeting was positive, with 12 votes in favour and none against or abstaining from the vote. Key questions were raised regarding demolition concerns. The Akim of Zhetygen village raised a question about how

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[43] Kazakhstan Temir Zholy. (n.d.). Construction of railway bypassing Almaty has begun. Kazakhstan Temir Zholy. Retrieved 13 February 2025, from https://railways.kz/en/news/construction-railway-bypassing-almaty-has-begun/

[44] Multilateral Investment Guarantee Agency. (n.d.). KTZ Railway project 1. Multilateral Investment Guarantee Agency. Retrieved 13 February 2025, from https://www.miga.org/project/ktz-railway-project-1

the population would be affected. This concern was addressed by a representative designer from Poligram who stated that the project was in the second stage of development and were open to discussing all issues transparently.

- **9 April 2024 in Kazybek Bek:** The minutes indicate that there was a total of 38 participants in the hearing and included presentations by "InTech". Key points of the hearings included:
    - **Construction Timeline:** Questions were asked regarding when the construction would start and its expected duration.
    - **Gas Pipeline Agreement:** There were concerns on whether the construction of the railway alignment would have effects on other international projects, such as the China-Central Asia China Gas Pipeline.
    - **Permit Acquisition:** Participants expressed concerns about obtaining necessary construction permits, especially in the context of pending agreements related to the gas pipeline.
    - **Environmental Concerns:** Some participants sought reassurance regarding environmental safeguards and mitigation strategies, though the specifics of these concerns were not detailed.
- **10 April 2024 in Iliy District:** The minutes of the hearing suggest that participants raised several concerns regarding the project, including:
    - **Questions on Route Alignment and Land Expropriation:** Concerns were raised about the railway's alignment and land acquisition issues, with requests for clearer explanations from project representatives.
    - **Compensation for Tree Cutting:** Participants expressed concerns regarding the lack of clarity on compensation for tree removal and the specifics of the planned replanting efforts.
    - **Call for Further Engagement:** The Akim of the Zhetygen Rural District suggested follow-up meetings with project representatives to discuss the ecological impacts and route details in more depth.
    - **General Support with Specific Concerns:** While there was overall support for the project, attendees sought reassurances about environmental safeguards and the adequacy of the mitigation strategies proposed.
- **10 April 2024 in Talgar District:** The hearing had an overall of 10 attendees who expressed favour during the meeting and supportive of the Project's proposals. The key concern was the **management of wastewater** and the absence of designated wastewater accumulation facilities in the Talgar District.

Land Acquisition

The overall process on land acquisition begun in May 2023. Since then, several public decree announcements from the various District Akimats of Almaty Oblast were issued. These include (in chronological order):

- Decree #231 dated 2 May 2023, issued by Karasay district Akimat
- Decree #145 dated 19 May 2023, issued by Zhambyl district Akimat

- Decree #05-230 dated 30 May 2023, issued by Talgar district Akimat
- Decree #305 dated 1 June 2023, issued by Iliy district Akimat
- Decree #266 dated 28 Sep 2023, issued by Zhambyl district Akimat
- Decree #03-91 dated 12 March 2024, issued by Talgar district Akimat
- Decree # 96 dated 12 December 2024, issued by Alatau City Akimat

Between June 2023 to January 2024, several engagements between the local executive Akimats, valuators, the landowners/users, the Court, the standing commission at the local representative body of the landowner/user, local executive bodies and entity that registers rights to land/real estate were held.

The purpose of the engagements was to notify landowners/users of the land acquisition, conduct valuation studies, reach a consensus on the agreement/disagreement on the valuation with the landowner/user, reconsider in case of disagreement, and, if failure to reach an agreement, file a claim for involuntary acquisition, with the possibility to appeal to the lawsuit.

Upon the court's decision, the local executive bodies, the standing commission at the local representative body of the landowner/user, executive agencies and body that registered rights to land/real estate would engage for the agreement preparations and submission of documents confirming payment of compensation.

The site visit by ERM, from 28 October – 8 November 2024 confirmed that not all land acquisition was fully complete. It was noted that land acquisition was complete for Zhambyl District (six (6) land plots), however Talgar District (32 out of 46 land plots acquired), Iliy District (26 out of 112 land plots acquired) and Karasay District (1 out of 5 acquired) were still on-going, for several reasons. Consultations with the Iliy Akimat representative indicated that land acquisition was expected to be completed by January 2025. Additional details are available in the LRP.

Discussions between KTZ and the Akimat of Alatau on 4 December 2024, after the site visit, indicated the possibility of additional land needed for acquisition around Zhetygen Station, in Alatau City. Although this has been planned, as indicated by KTZ, no formal decrees have been issued yet. On January 2025, the ERM team received a list of the potentially affected land plots in Zhetygen Station by KTZ, and, with the support from the Alatau City Land Department, had conducted 18 SSIs in the area.

4.2.3 FROM SEPTEMBER 2024 ONWARDS, AS PART OF THE SUPPLEMENTARY ESIA

Reconnaissance and Biodiversity Visit: 23 September – 04 October 2024

Between 23 September to 4 October 2024, a reconnaissance visit was carried out by selected ERM personnel. Key stakeholder meetings focused on the eastern part of the Almaty Bypass — specifically the Zhetygen bridge construction sites along the Kapchagay Traffic Road and Area 525, as well as construction points from 508 to 176 (Zhamanqum). Key observations were shared with KTZ, Integra and/or Poligram at the closure of the reconnaisance visit. A summary of the conducted activities included:

- Visited sections of the alignment accompanied by KTZ, Integra and/or Poligram.

- Initial meetings with Almaty Regional Land Committee and Ilyi District to obtain overall status of land acquisition, information clarifications and request for data.
- Discussions on mitigation and ongoing EHS and biodiversity safeguards with KTZ, Integra and Poligram.
- Meetings with Association for the Conservation of Biodiversity of Kazakhstan (ACBK).

Environment and Social Consultations: 28 October – 5 December 2024

Between 28 October to 5 December 2024, environment and consultations, as well as social surveys, were conducted with key stakeholders including: KTZ, EPC Contractors Poligram and Integra, District Akimat representatives, Cultural Heritage representatives and valuators. Key informant interviews (KII), focus group discussions (FGDs), community consultations and semi-structured interviews (SSI) with project affected entities were done at household level.

SSIs for Project Affected Entities (PAEs) were conducted for Zhambyl, Karasay and Iliy District[45]. The key social and environmental activities that were conducted can be summarised as:

- **Key stakeholder meetings:**
  - Meetings with KTZ and EPC Contractors Poligram and Integra for further clarification and request of pending data.
  - Meetings with District Akimats overall land acquisition status update and data clarifications.
- **KII, FGDs, Individual Community Consultations and SSIs:**
  - Key Informant Interviews with KTZ, EPC Contractors Poligram and Integra, District Akimat representatives, Cultural Heritage representatives, Valuators, subcontractors (including PTCM and KCT).
  - Focus Group Discussions and Community Consultations with women, farmers, lessees of government land, farm workers, informal users such as shepherd, railway workers, and workers in labour accommodation.
  - Semi-structured interviews with project affected entities, including women headed households, women respondents, people in the vulnerable groups category (including handicapped/physically disabled adult, senior citizen 60+ year, widow, low-income households).
- **Social Surveys along the alignment**:
  - Visit of the entire alignment by sections (including quarries, rivers, labour accommodation, and other ad-hoc social consultations) accompanied by KTZ, Integra and/or Poligram.
  - Cultural Heritage survey along key section of the alignment identified in the National EIA.

[45] Difficulties in coordinating SSIs in the Talgar District were encountered. A letter by the Almaty Region Transport Department to the Akimat of Talgar District requesting support to organise FGDs and help coordinate SSIs was obtained. However, due to social tensions unrelated to the Project in Talgar District and the transfer of some of the land plots from Talgar District to Alatau District, no SSIs in the Talgar District have occurred as of 16 January 2025.

Engagement with the Akimats

The four District Akimats of Talgar, Iliy, Karasay and Zhambyl were engaged extensively throughout the site visit. Later, the Alatau City land department was also consulted, over a conference call, on the issue of land acquisition. These engagements provided greater understanding of the specific land acquisitions process that was conducted within each district and allowed for clarifications based on the information received prior to the site visit. Gaps related to the land plots where acquisition was still on-going, as well as the additional 40 land plots that had been identified in Iliy District were clarified[46].

ERM conducted KIIs with the Akimats to gain a better understanding of the socio-economic conditions of the districts and the most common challenges faced by the community, including the owners and users directly affected by the Project. The District Akimats assisted in arranging SSIs with the identified households and KIIs with the Valuators of Talgar and Zhambyl District.

Based on the engagements, the Akimats are the key entity between the Project and the community, advising the Project on specific district requirements and concerns to be considered (i.e. locations of cattle crossing), and the entity where community members can receive information regarding the Project and raise grievances

Social Consultations with Zhetygen Station residents and Alatau City Land Department, KTZ and Poligram: 15 – 24 January 2025

Between 15 - 24 January 2025, ERM conducted social consultation with residents living in Zhetygen Station, as part of an on-going analysis of the potential for physical displacement at Alatau City. The Team was accompanied by representatives from the Alatau City Land Department. The Team identified approximately 22 structures, of which approximately 15 were considered residential structures in use. Three (3) of those residential structures did not have residents residing in them at the time of the interview (according to neighbours, some people had already moved away due to the Project’s land acquisition or for other reasons). The remaining seven (7) structures were either barns or small shops, which have since closed. Further SSIs were conducted in Alatau City.

The ERM team on site also conducted various data clarifications with KTZ and Poligram, especially for pending data pertaining to the OHTLs and clarifications on mitigation measures for the development of the ESMS by ERM.

Project Grievance Redressal Mechanism (GRM)

KTZ has a formal grievance redressal mechanism at corporate level, which includes:

- Integrated external and internal stakeholder GRM which allows for reporting of any violations of the Code of conduct, including cases of corruption, discrimination, unethical behaviour and other violations:
  - Toll free hotline
  - WhatsApp number

[46] The IFC Gap Analysis Report highlighted that an additional 40 land plots in Iliy were identified for acquisition, however at the time of receipt of the Report on 5 September 2024, the status of acquisition and compensation was still unclear.

- Internet portal managed by KTZ's parent company, Samruk Kazyna[47]
  - Email address
- Mobile application called "KTZ HSE", which provides an avenue for all workers (including contractor and subcontractor level) to raise grievances, where necessary. The KTZ HSE ISPB is also designed to enhance safety and operational efficiency within the workplace, and as such enables users to prevent potential hazards associated with daily work activities by reporting incidents and near misses. Workers interviewed noted that the app contains the hotlines mentioned in the KTZ website, and as such, is integrated with the overall corporate level GRM with the app providing an alternative option for workers to raise grievances.

Information pertaining to the different routes to raise grievances can be found in the company's website[48].

KTZ's website also includes a shortcut to "E-Otinish"[49], which is the official Kazakh government single-window portal for handling all types of inquiries from individuals to legal entities. During the SSIs, PAEs cited the use of E-Otinish to raise their grievances on the land acquisition process.

Based on the FGDs and Community Consultations, it was determined that the community are heavily reliant on the Akimats for raising grievances. Key grievances during the social consultations can be summarised as:

- **Protection of livestock** from the Projects construction activities.
- **Nuisance impacts** during construction and operation of the railway and the need for measures such as noise barriers.
- **Loss of access to land** due to the fragmentation of the land plots.

Further information on the stakeholder engagements conducted as part of the Supplementary ESIA and the grievance redressal mechanism is provided in the Social Impact Assessment (SIA) in **Section 7** and the separate documents: Stakeholder Engagement Plan (SEP), Livelihood Restoration Plan (LRP) and Construction Environmental and Social Management System (CESMS).

4.3 STAKEHOLDER IDENTIFICATION AND CATEGORISATION

"Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively. Stakeholders may include locally affected communities or individuals and their formal and informal representatives, national or local government authorities, politicians, religious leaders, civil society organisations and groups with special interests, the academic community, or other businesses[50]."

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[47] Samruk Kazyna. (n.d.). Samruk Kazyna: KTZ's parent company. Retrieved from https://sk-hotline.kz/#/
[48] Kazakhstan Temir Zholy. (n.d.). Contacts. Kazakhstan Temir Zholy. Retrieved from https://railways.kz/en/contacts/
[49] Eotinish. (n.d.). Home page. Eotinish. Retrieved from https://eotinish.kz/ru
[50] International Finance Corporation. (n.d.). Stakeholder engagement: A good practice handbook for companies doing business in emerging markets. Retrieved August 2024, from https://www.ifc.org/wps/wcm/connect/affbc005-2569-4e58-9962-280c483baa12/IFC_StakeholderEngagement.pdf?MOD=AJPERES&CVID=jkD13-p

Stakeholders are divided into those who:

- Are most likely to experience, potential negative and/or positive impacts resulting from the Project;
- Have an interest for the various elements of the Project's activities (such as national or local government authorities, civil society organisations, NGOs and groups with special interests, the academic community, or other businesses, etc.); and
- Are considered vulnerable members of the community within the proposed Project area.

With these considerations, two (2) principal categories of stakeholders are initially identified as follows:

- Affected Parties: people/entities directly affected by the Project and/or have been identified as most vulnerable to change and who need to be engaged in identifying impacts and their significance, as well as in decision-making on mitigation and management measures. Local communities from the district Akimats, farmers, vulnerable peoples, commercial agriculture companies, and workers in the area etc. are considered for this group; and
- Other Interested Parties: this stakeholder group consists of people/entities whose interest is to ensure the Project operates in accordance with applicable laws and mitigate all adverse impacts. If their demands are not met, they may report a negative aspect of the Project activities, which in turn could have a negative effect on the Client's reputation and potentially cause issues in the Project operation and activities. These stakeholder groups include government authorities, NGOs and others.

In accordance with Lenders' requirements regarding stakeholder engagement, ERM has identified various individuals and groups who (i) are affected or likely to be affected (directly or indirectly) by the Project (affected parties), or (ii) may have an interest in the Project (other interested parties).

4.3.1 AKIMATS

As described in **Section 2**, the Project is located across five (5) District Akimats of Karasay, Zhambyl, Iliy, Talgar and Alatau City[51] within the in Regional Akimat of Almaty Oblast.

Key Akimats have been identified in **Table 4-1**.

TABLE 4-1: LIST OF IDENTIFIED AKIMATS

No	Akimat	Nearby Project Component
1	Almaty Region Oblast **Includes Almaty Regional Land Committee*	The entire Almaty Bypass. **Almaty Regional Land Committee coordinates across the Akimats.*
2	Zhambyl Akimat	Kazybek Bek Station (existing)
3	Karasay Akimat	Kazybek Bek Station (existing)

[51] Alatau City Akimat is considered a key stakeholder with the inclusion of the city as a city of regional significance in January 2024, and with the transfer of land plots from Ilit and Talgar to Alatau.

No	Akimat	Nearby Project Component
4	Iliy Akimat	Sorbulak Station (planned station); Moyinkum station (planned station); Zhana Arna Station (planned station); Zhetygen B Station (planned station); Zhetygen A Station (existing station).
5	Talgar Akimat	Zhetygen B Station (planned station); Zhetygen A Station (existing station).
6	Alatau City Akimat	Zhetygen B Station (planned station); Zhetygen A Station (existing station).

4.3.2 IDENTIFICATION OF VULNERABLE GROUPS

Stakeholder identification and engagement also seeks to identify any potentially vulnerable or disadvantaged individuals and groups in the impacted communities. According to WHO (2018), vulnerable groups apply to groups of people (children, pregnant women, elderly people, malnourished people, prisoners, migrants and refugees, people who uses drugs, and people who are ill or immune compromised, etc.) who, due to factors usually considered outside their control, do not have the same opportunities as other, more fortunate groups in society.

Vulnerable groups are those who may be differently or disproportionately affected by the Project, or whose situation may mean that special care is needed to engage them in consultation and information dissemination activities. Vulnerable groups are defined by the IFC PS as: "*Disadvantaged or vulnerable status may stem from an individual's or group's race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth, or other status. The client should also consider factors such as gender, age, ethnicity, culture, literacy, sickness, physical or mental disability, poverty or economic disadvantage, and dependence on unique natural resources*[52]*"*.

This Project proposes to categorise vulnerable groups using the following criteria. While any one of the below would qualify the person or households as vulnerable, if more than one of the below applied, the household would be considered very vulnerable:

- **Economically vulnerable groups**: The minimum wage in Kazakhstan is 85,000 tengge (USD$160) per month, as of January 2024. Economically vulnerable group are considered those under low-income households, those making between 1 to 2 million tengge (USD$1,935 to USD$3,794) per annum;
- **Elderly people and / or households with only elderly members (over 63 years of age for men and 58 years for women)**: This vulnerable group includes those older than retirement age (see ages for men and women above), with no young working-age members in the household;
- **People with mental or physical disabilities** (e.g., albinism or mentally disabled people): This vulnerable group includes those with disabilities that affects their ability to gain an income; and
- **Female headed households**: This vulnerable group includes female headed households or widows.

[52] IFC (2012). IFC Performance Standards on Environmental and Social Sustainability. Retrieved from: https://www.ifc.org/content/dam/ifc/doc/mgrt/ifc-performance-standards.pdf [Accessed in August 2024]

Indigenous peoples (IPs) are generally considered part of the vulnerable people group. However, as noted in the National EIA and consultation with the District Akimats, there are no Indigenous Peoples located within the Projects AoI. Therefore, IPs are excluded from the Stakeholder Group Categorisation at this stage.

Preliminarily identified stakeholder groups are presented in the **Table 4-2** below.

TABLE 4-2: STAKEHOLDER GROUP CATEGORISATION

Stakeholder Group	Stakeholders
Affected Parties	
Landowners and users (organisations and individuals) who will be affected by permanent or temporary acquisition of land for the Project	Landowners, land users, commercial entities, physically displaced households, settlements along the alignment to be potentially affected by land acquisition due to changes in Project design. Out of the project affected 284 land plots, a combined 219 land plots are under private ownership / leased ownership. Private ownership accounts for 167 land plots, of which 145 are under peasant farming, eight (8) under commercial agriculture and 14 under other. Leased land from the government accounts for 52 land plots, of which 33 are on a leased farming agreement, 10 land plots under commercial agriculture and nine (9) plots under other.
Local communities near the Almaty Bypass railway line and quarries	People residing in immediate proximity to the Almaty Bypass railway (residents of settlements in Zhambyl, Karasay, Talgar, Iliy and Alatau City).People residing close to the quarries (refer to **Figure 2-2** for the location of the quarries);
Vulnerable community groups potentially affected by the Project	Local residents who may be difficult to engage due to age, disability, education level, social or economic status, etc.
Workers and employees, either directly employed on the project or working for contractors/sub-contractors on the Project	Workers and employees, either directly employed on the project at full-time or project basis, and/or working for contractors/sub-contractors on the Project.
Other Interested Parties	
Akimats	Regional Akimat of Almaty Oblast. District Akimats of Zhambyl, Karasay, Talgar, Iliy and Alatau City. Village Akimats of Kazybek Bek, Zhetygen and other relevant village Akimats.
Public authorities and regulators	Public authorities and regulators responsible for the approvals, permits, ensuring compliance, and oversight of construction activities related to Project.
Organisations and companies working on the Project, including contractors/subcontractors	EPC Contractors including Poligram and Integra, design developers and design organisations, Project partners and consultants, suppliers and construction contractors, shareholders and lenders.

Stakeholder Group	Stakeholders
Non-government organisations and independent experts	Specialised environmental, social, and research organisations, non-government organisations and community organisations (including Community Councils, Council of elders, community informal leaders).
Mass media	Printed mass media of regional, district, and municipal level, Television, Internet resources

4.4 STAKEHOLDER MAPPING

The following matrix (**FIGURE 4-1**) will be used to map the stakeholders. The Stakeholder Matrix is a dynamic tool that should be periodically updated as and when interest and/or influences of each stakeholder changes over the Project implementation period. Depending on the level of interest and influence of the stakeholder, it is placed into one of the four quadrants. Each group of stakeholders requires different engagement strategies. This is a preliminary mapping and can be revised as the Project progresses into later stages of stakeholder engagement. The main factors taken into account when identifying stakeholders are:

- Their attitude towards the project as measured by the extent to which the stakeholder will "back" (support) or "block" (resist);
- Their influence/power or ability to influence. This may be measured according to their potential to influence others, derived from their position or resource power, or may be their actual influence derived from their credibility as a leader or expert; and
- Their interest in the Project as measured by the extent to which they will be active or passive.

Key stakeholders will be then categorised and analysed according to their influence and interest in the Project and classified into four (4) groups to determine management actions: Informing, C, Monitoring and Engaging (**FIGURE 4-1**). Depending on the results of the mapping, engagement strategies will be suggested specifically to each group. This includes:

- **Collaborate**/manage closely (high power/high interest): The stakeholders should be managed closely. This includes regular engagement and consultation;
- **Inform**/Keep satisfied (high power/low interest): The stakeholders should be engaged and consulted on issues of interest;
- **Engage**/Keep informed (low power/high interest): The stakeholders should be kept informed and should be consulted on key interest areas; and
- **Monitor** (low power/low interest): The stakeholders should be monitored and kept informed about the Project (e.g., through factsheets and media notifications).

At this stage, ERM envisages that the stakeholders most likely to be impacted or to be most influential in terms of the successful delivery of the Project are:

FIGURE 4-1: STAKEHOLDER MAPPING MATRIX

Inform

- Valuators
- Margulan Institute of Archaeology
- Association for the Conservation of Biodiversity of Kazakhstan (ACBK)
- BirdLife International

Collaborate

- Government of Kazakhstan, through the Ministries
- NC JSC "State Corporation "Government for Citizens" in the Almaty region
- Almaty Oblast Akimat
- District Akimat of Zhambyl, Karasay, Talgar, Iliy, and Alatau City Akimat
- Village Akimat of Zhetygen Village and Kazybek Bek
- Department of Construction, Architecture and Urban Planning of Zhambyl, Karasay, Talgar, Iliy and Alatau
- Integra Construction KZ LLP ("Integra")
- Poligram LLP ("Poligram")
- PAEs of 274+ land plots, including the 209 land plots under private ownership / leased agreements.
- Workers and employees on the Project

Monitor

- Other Vulnerable Groups and individuals (interested parties)
    - Senior/Elderly Citizens
    - People with Disabilities/Limited Mobility
    - Female Headed Households
    - Economically vulnerable groups
- Local groups and associations (for example):
    - Association of Farmers
    - Association of Veterans
- Association of Mothers

Engage

- Joint Stock Company Intergas Central Asia ("Intergas Central Asia")
- Committee for Environmental Regulation and Control (CERC), Ministry of Ecology and Natural Resources of the Republic of Kazakhstan
- Balkhash-Alakol Basin Inspectorate for Use and Protection of Water Resources, Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan
- Kazakhstan Electricity Grid Operating Company ("KEGOC")
- Geo Energy Group LLP ("Geo Energy")
- IP InTech
- San Munai Gas LLP ("San Munai Gas")
- National Company QazAvtoJol JSC ("QazAvtoJol"), Almaty Regional Branch
- Republican State Enterprise "State Non-Departmental Examination of Projects" ("RSE GOS Expertiza")
- Physically displaced households, including those identified as vulnerable communities
- Local communities near the Almaty Bypass railway line and quarries
- Economically Marginalised Families

Influence/Power of Stakeholder (vertical axis)

Interest of Stakeholder (horizontal axis)

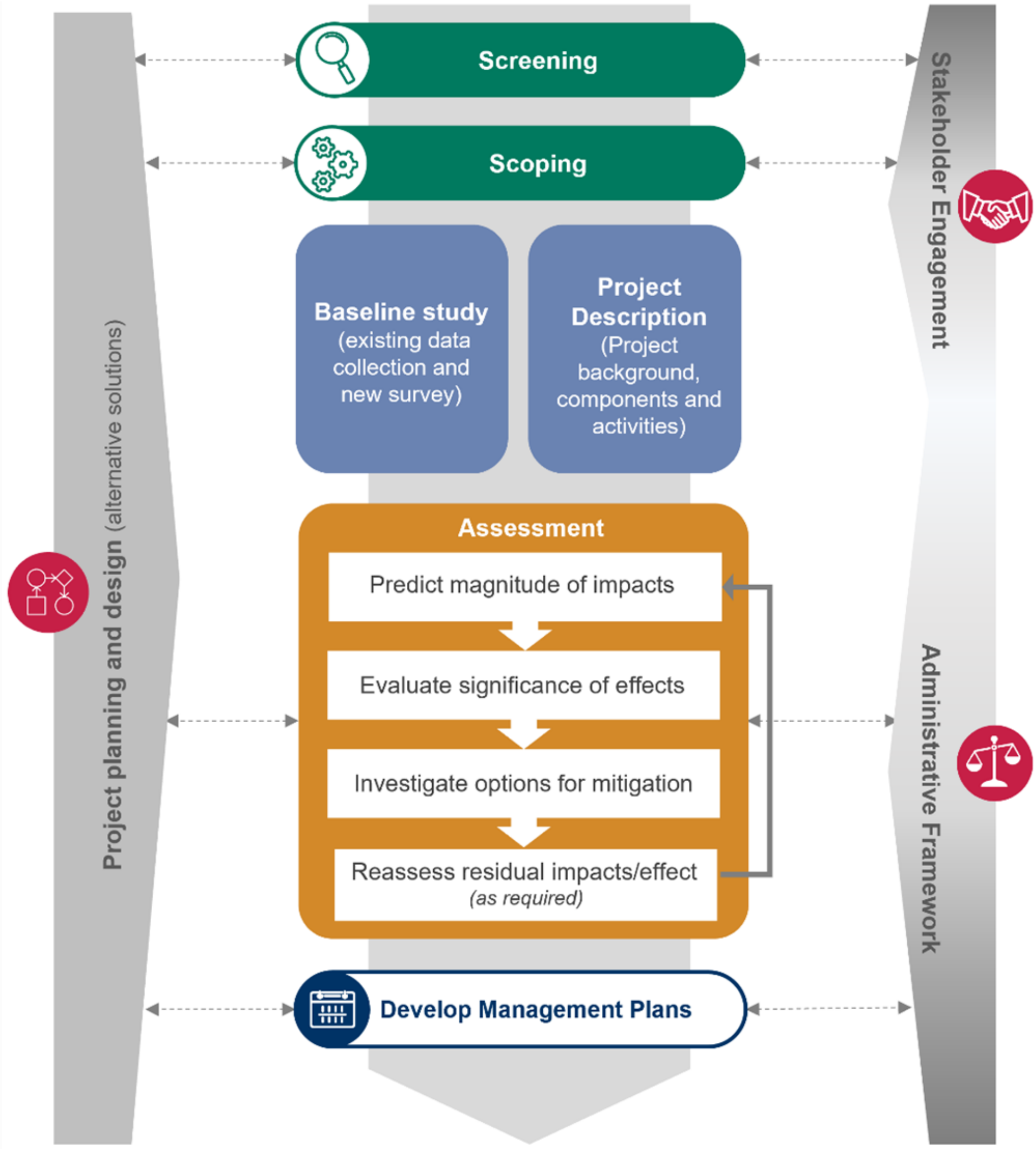
5. IMPACT ASSESSMENT METHOD

5.1 INTRODUCTION

The Impact Assessment (IA) for the Supplementary ESIA has been undertaken following a process that identifies, predicts and evaluates the impacts that the Almaty Railway Bypass is expected to have on aspects of the physical, biological and social environment and identifies measures that will be taken to avoid, reduce, mitigate, remedy/compensate, or offset for adverse impacts and to provide benefits, as far as reasonably practicable.

The overall approach followed is shown schematically in **Figure 5-1.**

FIGURE 5-1: ERM'S IMPACT ASSESSMENT METHODOLOGY



5.2 SCREENING

An Environmental and Social Due Diligence (ESDD) was conducted by the Lenders prior to ERM's engagement. The findings of the ESDD and the documentation collected were provided to ERM at the onset of the Project. The ESDD identified the main gaps that need to be addressed in the Supplementary ESIA relate to:

- Insufficient definition of the project Area of Influence (AoI).
- Limited baseline information and impact assessment related to biodiversity and ecosystem services, cultural heritage, landscape and visual amenities, land use and ownership and other social receptors.
- Lack of consideration for project climate change impacts and potential impacts of extreme weather events.
- Need for specialist studies on key impacts such as land acquisition, severance, community health, operational safety and biodiversity impacts.

5.3 SCOPING

The Scoping phase was undertaken concurrently with ERM's reconnaissance activities to delineate the AoI for the Project and to identify potential interactions between the Project and receptors in the AoI. Impacts were prioritised based on legislation, policy, industry good practice, the judgement of the specialists within the team, knowledge of the Project-affected area and results of the stakeholder engagement. This scoping stage is intended to ensure that the impact assessment focuses on those issues that are likely to result in significant effects.

ERM conducted the gap analysis of the National EIA against the Lenders applicable standards to confirm and expand on the ESDD. This gap analysis included a review of project documentation and public domain information to establish an understanding of the local and regional risks that are pertinent for the construction and operations of the Project. The gap assessment also included a reconnaissance site visit from 23 September to 4 October 2024.

The aspects and activities that are **scoped in** and shall be further assessed at the ESIA stage are documented in each aspect's subsection in the EIA and SIA sections, **Section 6** and **Section 7** respectively, and summarised in **Table 5-1**. The findings were prepared based on ERM's professional judgement and the information provided at the time of writing. Since then, ERM has revisited and updated the impacts based on additional project design and technical information and documentation provided by KTZ. Interactions that are no longer assessed to be significant are **scoped out** and shall not be further assessed at the ESIA stage, as based on new information and/or existing control measures are considered sufficient to deem the impacts insignificant. These are documented in each aspect's section.

TABLE 5-1: SCOPED-IN SUMMARY

Section	Receptor/ Resource	Project Activity	Rationale to Scope In
6.	**Physical Environment**		
6.2	Air Quality	**Construction Phase** • Construction of railway bypass and temporary ancillary facilities • Procurement of material and operation of borrow pits • Site preparation/Land clearing • Earthworks (Cutting and Filling) • Construction of bridges, culverts / drainage and transmission lines • • **Operation Phase** • Traffic exhaust from increased traffic to train stations	• Each of these activities has the potential to significantly impact local air quality through dust generation and emissions from construction equipment and transport vehicles. • During the operation phase, vehicles using the road will be the primary source of air pollutants. Air quality impacts primarily arise from traffic-related emissions and road dust resuspension. • During operation phase, the main emission sources envisioned will be operational traffic arising due to vehicles accessing stations.
6.3	Noise & Vibration	**Construction Phase** • Construction of railway bypass and temporary ancillary facilities • Procurement of material and operation of borrow pits • Site preparation/Land clearing • Earthworks (Cutting and Filling) • Construction of bridges, culverts / drainage and transmission lines • **Operation Phase** • Railway and train stations operation noise and vibration	Construction activities like grading, paving, and retaining wall construction involve heavy machinery (rollers, pavers, compactors), which generate high levels of noise and vibrations. These can affect nearby sensitive areas. During the operational phase, train operation is the main source of noise and vibration. Train stations that are located in residential settlements will impose noise and vibration impacts to the nearby NSRs.
6.4	Surface Water	**Construction Phase** • Construction of railway bypass and temporary ancillary facilities	In the construction phase, activities such as material procurement, land clearing, earthworks, river training, and bridge construction can have significant impacts on surface

Section	Receptor/ Resource	Project Activity	Rationale to Scope In
		• Procurement of material and operation of borrow pits • Site preparation/Land clearing • Earthworks (Cutting and Filling) • Construction of bridges, culverts / drainage and transmission lines **Operation Phase** • Railway operation on surface water quality and hydrology	water quality and flow. The primary concerns include sediment runoff, turbidity, contamination from chemicals and oils, and alteration of natural water flows. These changes can degrade water quality, affect aquatic ecosystems, and alter hydrological patterns, leading to potential flooding or erosion. During operation phase, the increase in stormwater peak flow contributions to watercourses can lead to increased water levels and subsequent floods to surrounding areas adjacent to channels due to land use change from land clearance. As for hydrology, it is expected that the permanent infrastructure (bridges and culverts) along the railway has the potential to disrupt local drainage patterns and cause upstream flooding by restricting high flows if they are inadequately sized or designed.
6.5	Soil and Ground Water	**Construction Phase** • Construction of railway bypass and temporary ancillary facilities • Procurement of material and operation of borrow pits • Site preparation/Land clearing • Earthworks (Cutting and Filling) • Construction of bridges, culverts / drainage and transmission lines • **Operation Phase** • Railway operation on ground water quality and soil erosion	In the construction phase, activities such as site preparation, earthworks, road construction, and the construction of bridges, culverts and drainage structures can significantly impact both soil and groundwater systems. Key concerns include the changes to groundwater recharge and potential groundwater contamination. As for soils, it can lead to increased erosion, sediment mobilisation, and sedimentation in nearby water bodies. These processes can degrade soil quality, increase turbidity, and negatively affect aquatic ecosystems. During operation phase, there is a potential for direct soil and/or groundwater contamination within the project footprint due to diesel oil leakage from station operations, improper handling of hazardous chemicals, inadequate

Section	Receptor/ Resource	Project Activity	Rationale to Scope In
			management of toxic chemical waste, and wastewater generation.
6.6	Biodiversity	**Construction Phase** • Construction of railway bypass and temporary ancillary facilities • Procurement of material and operation of borrow pits • Site preparation/Land clearing • Earthworks (Cutting and Filling) • Construction of bridges, culverts / drainage and transmission lines **Operation Phase** • Train and train station operation	For construction phase, the site preparation activities will require clearance of vegetation which leads to direct impact (vegetation loss) on the habitat and species. It can also inadvertently facilitate the introduction and spread of invasive alien species (IAS) through various pathways. The railway alignment will intersect the Uzyn Kargaly, Zhyngyldy, Zhamankyul, Kaskelen, Malaya Almatinka, and Karasu Baiserke rivers as well as irrigation canals, which will impose impacts on aquatic ecology. Railway infrastructure poses a range of risks to wildlife, impacting avifauna, herpetofauna, and mammals through direct mortality, habitat fragmentation, and behavioural changes. During the operation stage of a railway project, habitat degradation will be primarily driven by disturbances such as noise, light exposure from passing trains, and pollution, including emissions from maintenance equipment and increased vehicular traffic along access roads. There are possible impacts of transmission line on biodiversity on bird mortality due to collision and electrocution.
6.7	Greenhouse Gas Emission	**Construction Phase** • Construction of railway bypass and temporary ancillary facilities • Procurement of material and operation of borrow pits • Site preparation/Land clearing • Earthworks (Cutting and Filling)	The construction phase primarily generates emissions from fuel combustion in heavy machinery, material transportation, and vegetation clearing, while the operational phase sees long-term emissions from stationary combustion from boiler rooms.

Section	Receptor/ Resource	Project Activity	Rationale to Scope In
		• Construction of bridges, culverts / drainage and transmission lines • **Operation Phase** • Train station operation	
6.8 6.9	Climate Change	**Construction Phase** • Construction of railway bypass and temporary ancillary facilities • Procurement of material and operation of borrow pits • Site preparation/Land clearing • Earthworks (Cutting and Filling) • Construction of bridges, culverts / drainage and transmission lines • **Operation Phase** • Train and train station operation	Climate risks such as extreme cold/heat, floods and wildfires may financially impact organisations through direct damage to assets and indirect consequences, such as supply chain disruptions.
7	**Social**		
7.10	Cultural Heritage	**Pre-Construction Phase** Land acquisition for right-of-way (RoW) • **Construction Phase** Site preparation/Land clearing Earthworks (Cutting and Filling) Road construction & retaining walls Construction of culverts / drainage and water management structure	Kurgan burial mounds are common in Kazakhstan and date back from the Iron Ages. A study by Margulan University Institute of Archaeology had identified three (3) sites Cultural Heritage objects. The study determined that the land acquired for the right-of-way does not impact the CH sites. Additional CH screening checklists, chance finds procedure and a kurgan mitigation and management guideline are needed for the construction phase of the project, should any new CH objects be found by workers during construction activities.

Section	Receptor/ Resource	Project Activity	Rationale to Scope In
	Landowners, leaseholders, land users and commercial entities	**Pre-Construction Phase** Permanent land acquisition for Project footprint: 284 land plots amounting to over 10564300 m2.	The Project requires permanent land acquisition which will result in physical displacement, particularly for affected households around Zhetygen Station, and economic displacement for affected landowners and users. Those dependent on land-based activities such as agriculture and grazing may experience income and livelihood losses, while land fragmentation could further reduce accessibility and usability.
7.6	Workers on lands impacted by land acquisition	**Pre-Construction Phase** Permanent land acquisition for Project footprint: 284 land plots amounting to over 10564300 m2.	The Project's land requirements will impact commercial entities, which can potentially cause employment loss and other related economic disruptions.
7.6	Local settlements along the alignment	**Pre-Construction Phase** Permanent land acquisition for Project footprint: 284 land plots amounting to over 10564300 m2.	The Project's land acquisition may impact local settlements by reducing access to communal grazing lands and disrupting daily mobility and economic activities.
7.7	Workers in the rail industry; Almaty region and the national economy	**Construction Phase** Construction works; and the Project as a driver to other developments such as the Special Economic Zone at Kazybek Bek **Operations Phase** • Opportunities for direct employment in railway operations and maintenance; indirect economic opportunities due to rail activity and increased connectivity for cargo transport.	The Project will create 1,400 jobs during construction, with 600 roles in railway operations and maintenance, ensuring sustained employment. Local procurement rules further support domestic businesses. Rail operations will boost local economies, increase freight capacity, and generate government revenue, driving industrial investments like the planned SEZ in Kazybek Bek.

Section	Receptor/ Resource	Project Activity	Rationale to Scope In
7.7 7.8	Construction and operational workforce: Labour and working conditions	**Construction Phase** • Employment of 1,500 workers during construction **Operations Phase** • Employment of 500 workers during operations.	The Project employs 1,500 workers during construction and a permanent workforce for operations, exposing them to Occupational Health and Safety risks such as hazardous work environments, fatigue, and chemical exposure. Gaps in Kazakhstan's Labour Code compared to IFC PS2—including migrant worker protections, discrimination enforcement, and worker accommodations—warrant assessment. Ensuring safe and fair working conditions is critical for both construction and operations.
7.7 7.8	Community health and safety	**Construction Phase** • Construction works across the alignment **Operations Phase** • Operations of 27 freight trains per day for each direction; total 54 trains in both directions per day	The Project poses community health and safety risks during construction and operation, including traffic accidents, noise, dust, public infrastructure strain, and security concerns. During operations, level crossing accidents, noise exposure, and security risks require mitigation. Given these risks, assessment is necessary.
7.7 7.8	Gender-differentiated impacts on women	**Pre-Construction Phase:** • Gendered impacts on women due to land acquisition for Project footprint **Construction Phase:** • Increased risk of gender-based violence (GBV) due to workforce in-migration and changes in land use. **Operations Phase**: • Limited employment opportunities for women; safety concerns for women	The Project may disproportionately impact women, especially in rural and women-headed households, due to land loss, increased workload, reduced income, and safety risks. Workforce in-migration may heighten gender-based violence (GBV) risks, while railway operations offer limited employment but improved mobility. These gendered impacts warrant assessment.

5.4 E&S EARLY-STAGE DATA COLLECTION

As noted in the Limitations (**Section 1.3**), at the time of ERM's engagement (Q3 2024), the Project was under construction, as land preparation and construction works had commenced in November 2023. The approach for the early-stage data collection was tailored in consideration of the following:

- Land acquisition is at an advanced stage and was expected to be completed by end of 2024. As of the latest site visit in January 2025, the land acquisition process is yet to be complete as the final boundaries for Kazybek Bek Station and Zhetygen Station have not yet been finalised.
- Construction activities commenced in November 2023, and as of September 2024, early works as well as earthworks have been undertaken across the entire alignment.
- No socio-economic baseline or household surveys has been conducted for the owners and/or users of the affected land plots (private and/or government). The available information lists the entities associated with each affected land plot, area impacted, land use prior to acquisition, total compensation and status of acquisition.

Where possible, ERM utilised public information, information collected during the National EIA or project specific studies to inform the pre-project conditions. Recognising the constraints, ERM developed a targeted on-site data collection process to address the identified gaps which was documented in the Early-Stage E&S Survey Design Memo. The data collection approach is summarised below, with the results of the early-stage data collection for each aspect summarised in the relevant subsections in **Section 5.4.1** and **5.4.2**.

5.4.1 ENVIRONMENTAL

5.4.1.1 PHYSICAL ENVIRONMENTAL

No primary data for physical environmental receptors (air, noise, surface water, soil or groundwater) was collected during the National EIA.

Short-term noise measurements (5-min) were conducted by ERM at identified sensitive receptors within the Project's AoI. Based on the results of the short-term monitoring, three (3) locations were taken forward for long-term monitoring during day and nighttime for a 1-hr time period.

During the site visit, ERM conducted visual assessments at key sensitive receptors and project areas to determine the extent of construction works, identify any pollution sources and record photographic evidence. Selected stream/river crossings, groundwater wells and quarries/borrow areas were visited.

5.4.1.2 BIODIVERSITY

No biodiversity primary data was collected during the National EIA. The biodiversity site visit of the Project's AoI was conducted to understand the extent of modified and natural habitats, the vegetation types of these habitats and any unique geographical features. The site assessment also included visiting Key Biodiversity Areas in proximity to the railway alignment specifically, the Sorbulak Lake Complex. Based on the land use map prepared, primary data was collected through selected habitat and waterbody surveys, point counts and transect surveys.

Consultations were carried out with subject matter experts from Association for the Conservation of Biodiversity in Kazakhstan (ACBK), governmental agencies (Regional Committee of Wildlife and Forestry) and independent researchers to understand the distribution and behaviour of the species identified in the region.

5.4.2 SOCIAL

5.4.2.1 SOCIAL

As baseline socio-economic data was not collected during the National EIA and there is limited secondary information sources, the data collected during Supplementary ESIA during the early-stage of construction is used to retrospectively construct some pre-project socioeconomic benchmarks for the project-affected stakeholders at the settlement/district level, e.g. based on the land use category, size of holding and type of use.

ERM collected primary information through focus group discussions at a village level, key informant interviews of specific stakeholder groups/local authorities, and semi-structured interviews (SSIs) for selected impacted entities (**Section 4.2.3**). Based on an agreed targeted sampling approach with the Lenders, SSIs were undertaken for selected impacted entities (approximately 40) at a household level (one household per selected plot of land affected by the Project).

The semi-structured interviews are not intended to be a representative sample of all affected plots and stakeholders, but to focus on a variety of issues with plots that are still in the process of being acquired. However, a small sample of the plots where acquisition has been completed is included to develop benchmarks for the pre-project livelihoods baseline.

Stakeholder feedback obtained during the various site engagement activities (SSIs, FGDs, KIIs) was used to identify the Valued Environmental Components (VECs) of particular concern to be assessed in the Rapid Cumulative Impact Assessment (RCIA). Together with the secondary data collected during the rapid review stage, the engagements have assisted to confirm the known developments within, or likely to have impacts that overlap with the Project AoI.

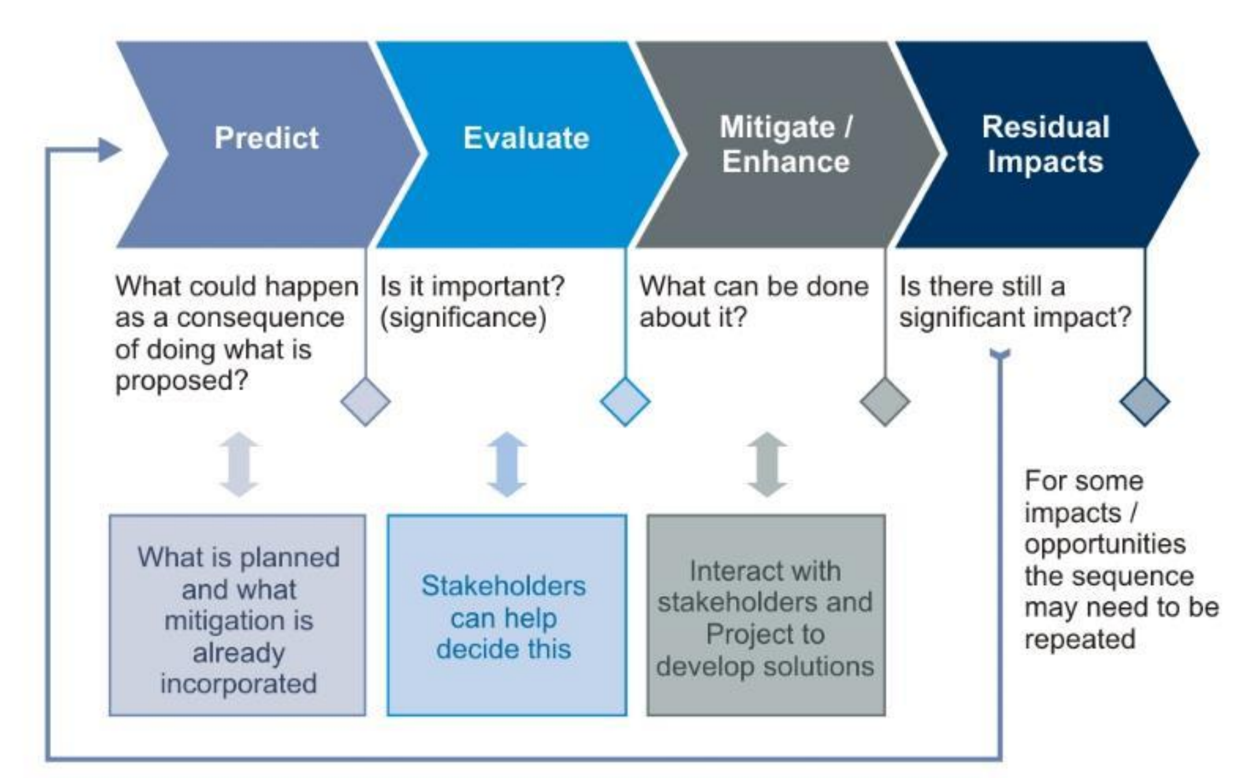
5.4.2.2 CULTURAL HERITAGE

During the site visit ERM visited the area where the National Cultural Heritage (CH) site Zamankum based on the information provided by Antique at the time of the site visit. ERM conducted visual observations documenting any cultural heritage sites (i.e. mounds, ritual buildings) and the surrounding environmental conditions.

5.5 IMPACT ASSESSMENT PROCESS

The assessment of impacts involved an iterative process considering four (4) questions as illustrated in **Figure 5-2.**

FIGURE 5-2: IMPACT PREDICTION AND EVALUATION PROCESS



5.5.1 POTENTIAL IMPACT PREDICTION

Prediction of impacts is an objective exercise to determine what is likely to happen to the environment as a consequence of the Project and its associated activities. From the potentially significant interactions identified in the scoping phase, the impacts to the various resources/ receptors are further elaborated and evaluated.

It is important to note that impact prediction took into account any embedded controls i.e. physical or procedural controls that are planned to be put in place as part of the Project design, construction and operation from the outset.

5.5.2 IMPACT EVALUATION

The next step involves evaluating the significance of the predicted impacts by assessing their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor.

5.5.2.1 IMPACT MAGNITUDE

Magnitude describes the intensity of the change that is predicted to occur in the receptor as a result of the impact and is typically a function of some combination of the following impact characteristics presented in **Table 5-2.**

TABLE 5-2: IMPACT CHARACTERISTIC TERMINOLOGY

Characteristic	Definition	Designations
Type	A descriptor indicating the relationship of the potential impact to the Project (in terms of cause and effect).	• Direct • Indirect • Induced
Extent	The "reach" of the potential impact (e.g., confined to a small area around the Project Footprint, projected for several km, etc.).	• Local • Regional • International
Duration	The time period over which a receptor is potentially affected.	• Temporary • Short-term • Long-term • Permanent
Scale	The size of the potential impact (e.g., the size of the area with the potential to be damaged or impacted, the fraction of a resource that could potentially be lost or affected, etc.).	[no fixed designations; intended to be a numerical value or a qualitative description of "intensity"]
Frequency	A measure of the constancy or periodicity of the potential impact.	[no fixed designations; intended to be a numerical value or a qualitative description]

The definitions for the "type" designations are shown **Table 5-3**. Definitions for the other designations are receptor-specific and are discussed in the receptor-specific impact assessment sections presented later in the report.

TABLE 5-3: DESIGNATION DEFINITIONS

Designation	Definition
Type	
Direct	Potential impacts that result from a direct interaction between the Project and a resource/receptor (e.g., between occupation of a plot of land and the habitats which are affected).
Indirect	Potential impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g., viability of a species population resulting from loss of part of a habitat as a result of the Project occupying a plot of land).
Induced	Potential impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project (e.g., influx of workers resulting from the importation of a large Project workforce).
Extent	
Local	The impact is limited to the immediate area of the receptor being affected. For example: a local habitat or species population within a specific project boundary.
Regional	The receptor is larger in scale, covering multiple areas or communities. For example: Impacts on water quality affecting rivers that flow into nearby regions.
International	Impacts transcend national boundaries. For example: Migratory species or shared ecosystems impacted across countries.
Duration	
Temporary	Defined on a receptor-specific basis, for example noise disturbance may be temporary for humans but long-term for sensitive bird species.
Short-term	
Long-term	
Permanent	

The impact magnitude designations are:

- Positive
- Negligible (negative)
- Small (negative)
- Medium (negative)
- Large (negative)

For a positive impact, no magnitude designation (aside from 'positive') is assigned. It is considered sufficient for the purpose of this IA to indicate that the Project is expected to result in a positive impact, without characterising the exact degree of positive change likely to occur.

Impacts from planned activities/events do not consider likelihood as they are certain to occur. In the case of impacts resulting from unplanned events, the same receptor-specific approach described above is used, but 'likelihood' is also considered when determining magnitude and significance.

5.5.2.2 RECEPTOR SENSITIVITY

The impact magnitude combined with the sensitivity (inclusive of vulnerability and importance) an impacted receptor is used to determine the significance of impact. A range of factors were considered when defining the sensitivity of the receptor such as physical, biological, cultural or human. Other factors may also be considered such as legal protection, government policy, stakeholder views and economic value.

5.5.2.3 IMPACT SIGNIFICANCE

The impact magnitude and sensitivity of a resource or receptor were considered in combination to evaluate whether an impact was significant, and if so, its degree of significance. Impact significance was designated using the matrix shown in **Table 5-4.**

TABLE 5-4: SIGNIFICANCE OF IMPACT MATRIX

		Sensitivity of Receptor		
		Low	**Medium**	**High**
Impact magnitude	**Negligible**	**Negligible**	**Negligible**	**Negligible**
	Small	**Negligible**	**Minor**	**Moderate**
	Medium	**Minor**	**Moderate**	**Major**
	Large	**Moderate**	**Major**	**Major**

Impacts that are moderate or major are considered significant and warrant further consideration as to whether the impact has been reduced to as low as reasonably practicable (ALARP) and/or whether additional mitigation to reduce the impact is practical, feasible and cost-effective. Negligible and minor impacts are not significant (which is different from insignificant) and do not require further consideration for ALARP or mitigation. **Table 5-5** describes the impact significances.

TABLE 5-5: DESCRIPTION OF IMPACT SIGNIFICANCES

Significance	Description
Negligible	An impact of **negligible significance** is one where a receptor will essentially not be affected in any way by a particular activity, or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.
Minor	An impact of **minor significance** is one where a receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the receptor is of low sensitivity. In either case, the magnitude should be well within applicable standards.
Moderate	An impact of **moderate significance** has an impact magnitude that is within applicable standards, however, falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal

Significance	Description
	limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or causing a major impact is not best practice. The emphasis for moderate impacts is therefore on reducing them to a level that is as low as reasonably practicable (ALARP). This does not mean that impacts of moderate significance must be reduced to minor, but that moderate impacts are being managed effectively and efficiently.
Major	An impact of **major significance** is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive receptors. An aim of IA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area.

5.5.2.4 LIKELIHOOD (UNPLANNED EVENT)

In the case of unplanned events, i.e. unintended occurrences in the Project such as a fire emergency. An additional factor that is considered is likelihood. The likelihood of an unplanned event occurring is designated using a qualitative scale, as described in **Table 5-6**.

TABLE 5-6: DEFINITIONS FOR LIKELIHOOD DESIGNATIONS

Likelihood	Definition
Unlikely	The event is unlikely but may occur at some time during normal operating conditions.
Possible	The event is likely to occur at some time during normal operating conditions.
Likely	The event will occur during normal operating conditions (i.e., it is essentially inevitable).

5.5.3 IMPACT MITIGATION

Where a significant impact was identified, a hierarchy of options for mitigation were considered to identify the preferred approach:

- **Avoid at source, reduce at source**: avoiding or reducing at source through the design of the Project. For this Project, changes in the design may not be a feasible option as the Project is under construction.
- **Abate on site:** add something to the design to abate the impact (e.g. pollution control equipment, traffic controls etc.).
- **Abate at receptor:** if an impact cannot be abated on-site, then control measures can be implemented off-site.
- **Repair or remedy:** some impacts involve unavoidable damage to a resource and can be addressed through repair, restoration or reinstatement measures.
- **Compensate in kind, compensate through other means:** where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate.

5.5.4 RESIDUAL SIGNIFICANCE OF IMPACTS

In some cases, it may not be possible to reduce a negative impact any further. These impacts are therefore residual in the sense that they remain after mitigation measures have been designed into the intended activity. When a significance of impact is negligible or minor during the initial determination of significance, then the current Project design is deemed appropriate to maintain the risk at minimum. However, when a significance of impact is moderate or major during the initial determination of significance, further additional mitigation (after in consultation with the Project team on the feasibility) will be considered and determination of significance shall be reassessed. This is termed as residual significance of impact.

After implementing of additional mitigation measures and if the residual significance of impact still within moderate and above, it will then be described in this report with commentary on why further mitigation is not feasible.

Impact Management and Monitoring Measures to mitigate and manage impacts have been identified through this assessment. Furthermore, where uncertainty exists about the significance of an impact, monitoring has been recommended. These mitigation, management and monitoring measures are set out in **Section 9.4.2**, and have been compiled in an Environmental and Social Management Plan (ESMP) which is provided in **Section 1**.

The ESMP will provide input into the overall suite of management measures, which will be incorporated and implemented through the Environmental and Social Management System (ESMS). Both the ESMP and ESMS was prepared to meet lender and legal requirements and enable the Project to demonstrate the adequacy of its systems. The implementation of the ESMP and ESMS will be under the responsibility of the EPC Contractor.

5.5.5 CUMULATIVE IMPACTS

A cumulative impact arises from an impact from the Project interacting with an impact from another activity (either existing or proposed). It is noted that how cumulative impacts are assessed is strongly influenced by the status of the other developments (already ongoing or committed i.e. approved or proposed) and how much information is available. A Rapid Cumulative Impact Assessment (RCIA) process has been established for this Project outlined in **Section 10.**

5.6 DEALING WITH UNCERTAINTY

Even with a firm Project design and an unchanging environment, predictions are by definition uncertain. In this IA, predictions have been evaluated using qualitative assessments and subject matter judgment. The accuracy of predictions depends on the method and the quality of the input data on the Project and the environment. Where assumptions have been made, the nature of any uncertainties which stem from these are presented in each individual impact assessment sections.

6. ENVIRONMENTAL IMPACT ASSESSMENT

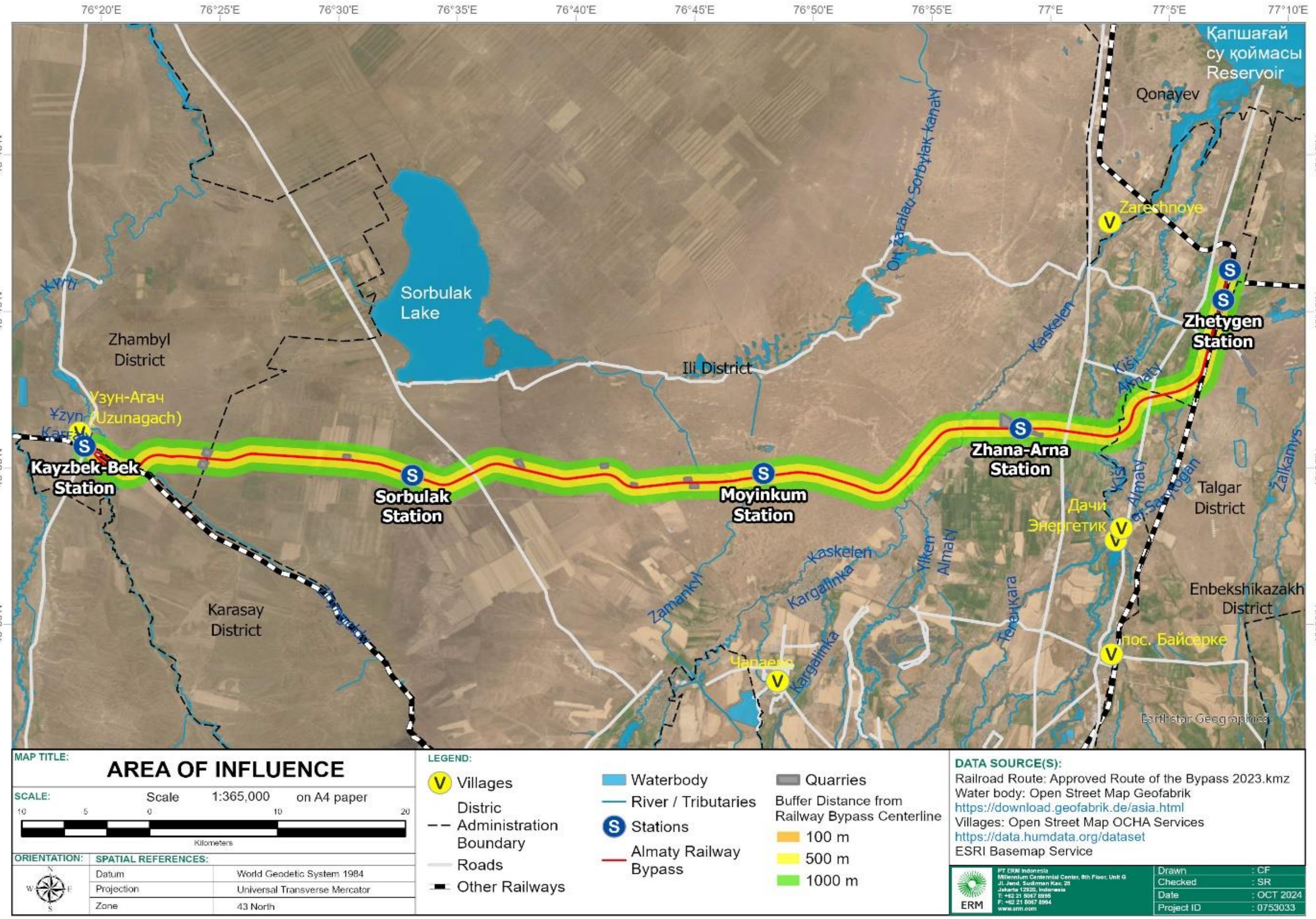
6.1 DEFINITION OF THE ENVIRONMENTAL AREA OF INFLUENCE (AOI)

The environmental Area of Influence (AoI) is typically defined in the impact assessment process to encompass the area likely to be affected by the Project and the activities that are directly owned, operated, or managed (including by contractors) that are a component of the project and the additional areas in which aspects of the environment could conceivably experience potential impacts. The AoI is relative to the specific environmental and social receptor or effect being assessed. Different AoI's for different environmental receptors have been considered and are further explained in **Table 6-1**. The Social AoI is presented in **Section 7.**

TABLE 6-1: AREA OF INFLUENCE (AOI) DESCRIPTION FOR ENVIRONMENTAL RECEPTORS

Environmental Receptor	AoI Description
Air	• 500m is considered from any construction activities and 200m from • construction access roads.
Noise and Vibration	• Defined as the area over which an increase in environmental noise levels due to the project can be detected. • 1km from both sides of the Almaty Bypass and 500m from point noise sources (quarries and construction sites).
Soil and Groundwater	• Limited to the soil and groundwater resources that are directly underneath or adjacent to the Project construction footprint (typically up to 100m). • However, the AoI also considers potential interactions with the broader groundwater catchment to account for cascade effects that may extend beyond the immediate project footprint.
Surface Water	• Focused on immediate surroundings of the Project Area that have the potential to be most impacted by proposed activities. • 1km either side of the Almaty Bypass centreline and associated infrastructure. • Additionally, the AoI considers potential interactions with the broader surface water catchment, recognising that effects such as channel modification due to siltation could extend beyond the immediate Project footprint.
Biodiversity	• The Project's Area of Influence has been delineated as the project footprint, along with an established corridor Right of Way (RoW), and an additional 500m on either side of the RoW. However, where project impacts could disrupt wider ecological patterns, processes, and distribution of relevant species or ecosystems beyond the immediate project area an Ecological Appropriate Area of Analysis as defined by the Guidance note for PS6 (2019) has been delineated.

FIGURE 6-1: ENVIRONMENTAL AREA OF INFLUENCE (AOI)



6.2 AIR QUALITY

6.2.1 LIMITATIONS

The Air Quality Section was prepared based on the following limitations:

- The assessment included a review of air dispersion modelling results for construction and operations from the National EIA and its limitations. Construction phase dust impacts were assessed using ERM's impact assessment methodology. Construction and operations phase traffic exhaust impacts were assessed by ERM using the ADMS-Roads dispersion model.
- Assumptions for traffic calculations as part of the ADMS-Road dispersion model during construction and operations are detailed below.
- The assessment was conducted based on Project information made available to ERM by AIIB, IFC, KTZ and subcontractors, site visit findings and readily available public information within the time limits of the study.
- No quantitative early-stage primary air quality data collection was conducted by ERM for the Project.

6.2.2 APPLICABLE REFERENCE FRAMEWORK

Applicable laws, directives, policy and guidance for air quality impacts are outlined in **Table 6-2**.

TABLE 6-2: AIR QUALITY APPLICABLE REGULATIONS AND GUIDELINES

Title	Year of the latest version
Law	
Constitution of the Republic of Kazakhstan	2022
Environmental Code of the Republic of Kazakhstan No. 400-VI ZRK	2024
Order of the Minister of Health of the Republic of Kazakhstan No. ҚР ДСМ-70 dated 2 August 2022, On Approval of Hygienic Standards for Atmospheric Air in Urban and Rural Settlements	2022
Order of the Minister of Health of the Republic of Kazakhstan dated 2 August 2022, No. ҚР ДСМ-70 "On Approval of Hygienic Standards for Atmospheric Air in Urban and Rural Settlements"	2022
Order of the Acting Minister of Health of the Republic of Kazakhstan dated 11 January 2022, No. ҚР ДСМ-2 "On Approval of Sanitary Rules 'Sanitary and Epidemiological Requirements for Sanitary Protection Zones of Objects Impacting the Environment and Human Health'	2022
Code of the Republic of Kazakhstan 'On Public Health and the Healthcare System' No. 360-VI ZRK dated 7 July 2020	2020
Construction Norms and Regulations of the Republic of Kazakhstan (SNiP RK 2.04-01-2010) 'Construction Climatology'	2010
Policy	

Title	Year of the latest version
World Health Organisation (WHO) Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulphur Dioxide.	2021
IFC Environmental and Social Performance Standards	2012
IFC Environmental, Health, and Safety Guidelines for Railways	2007
Guidance	
"Almaty City Development Program until 2025 with Medium-term Prospects until 2030" (Approved in 2022)	2022
Municipal Energy Efficiency Plan for the City of Almaty	2017
Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction	2024
Order of the Minister of Ecology, Geology, and Natural Resources of the Republic of Kazakhstan No. 280 dated 30 July 2021, 'On Approval of the Instruction on the Organisation and Conduct of Environmental Assessment'	2021
Methodology for the Formation of Environmental Statistics Indicators, Order No. 223	2015
Order of the Minister of Ecology, Geology, and Natural Resources of the Republic of Kazakhstan No. 63 dated 10 March 2021, 'On Approval of Methodologies for Determining Emission Standards into the Environment'	2021
Order of the Minister of Ecology, Geology, and Natural Resources of the Republic of Kazakhstan No. 166 dated 24 May 2021, 'On Approval of Document Forms Related to the Organisation and Conduct of State Environmental Control'	2021
ISO 14001:2015 'Environmental Management Systems — Requirements with Guidance for Use'	2015
ST RK 17.2.3.01-2005 'Environmental Protection. Atmosphere. Requirements for Air Pollution Control'	2005

6.2.3 EARLY-STAGE CONDITIONS

The Project location is in the foothills of the Ili Alatau mountain range which experiences altitudinal zonation and mountain-and-valley air circulation. It is on the Ili Depression and is characterised by an arid climate with moderately cold winters, fast and humid mid-seasons and hot and dry long summers. Summers are hot and dry with a maximum temperature of 24.0℃ and winters are cold and mild with temperatures dropping to -15.0℃[53].

According to the Köppen-Geiger climate classification, the climate within the Project area is defined as 'hot-summer humid continental' climate. According to the map of climatic zoning

[53] Poligram. (2023). Technical report based on the results of engineering and hydrometeorological surveys for the preparation of project documentation 754189/2022/1-Y.3. Poligram.

of SNiP 2.04-01-2010 (SNiP RK 2.04-01-2010 construction climatology) the subject area is situated in Climate Area III (Sub-area IIIB[54]).

The National Hydrometeorological Service of the Republic of Kazakhstan (Kazhydromet) publishes reports on the state of the environment, including air quality. The Kazhydromet air quality monitoring network includes both manual and automatic stations with continuous monitoring. The manual air quality stations measure the level of the different air pollutants by taking samples three or four times a day (at 7AM, 1PM, 7PM, and 1AM). The automatic air quality monitoring stations monitor air pollutants continuously, at 20-minute intervals. The network consists of 130 automatic and 40 manual monitoring stations monitoring a total of 35 pollutants, including the key air quality pollutants defined by the World Health Organisation (WHO) – PM (PM_{10} and $PM_{2.5}$), nitrogen oxides (NO_x) and sulphur dioxide (SO_2)[55]. The ambient air quality at Almaty city was assessed by Kazhydromet as having an Atmospheric Pollution Index 5 (API_5) of 5.9[56]. The Project is located 20km north of Almaty city. A summary of background ambient air quality pollutant concentrations provided by Kazhydromet against local air quality guidelines and WHO air quality guidelines is shown in **Table 6-3**. The Project did not conduct early-stage ambient air quality monitoring of primary data.

[54] Sub-area IIIB indicates a moderate climate region. The average monthly air temperature in January varies from -5°C to -14°C; the average monthly air temperature in July varies from +21°C to +25°C.
[55] World Bank Group. (2021). Cost-effective air quality management in Kazakhstan and its impact on greenhouse gas emissions. Retrieved February 13, 2025, from https://documents1.worldbank.org/curated/en/099345012232191779/pdf/P1708700d2bd3a09093fa0cd27991d0662.pdf
[56] An API5 of 5.9 corresponds to an "Increased" air pollution level. The API5 is the most important and commonly used index for urban air quality in Kazakhstan.

TABLE 6-3: BACKGROUND CONCENTRATIONS OF AMBIENT AIR QUALITY POLLUTANTS BY STATE AIR QUALITY MONITORING NETWORK (KAZHYDROMET) IN ALMATY IN 2023[57]

Pollutant	WHO AQ Guidelines, Daily Average concentration (mg/m^3) [a]	Maximum Permissible Concentrations of Air Pollutants [b]		2023 Daily average concentration		2023 Maximum concentration - One-Time Release	
		MPC_{DA}[c], mg/m^3	MPC_{MNR}[d], mg/m^3	mg/m^3	MPC_{DA} exceedance, times	mg/m^3	MPC_{MNR} exceedance, times
PM (dust)	N/A	0.15	0.5	0.17	1.2	0.55	1.1
$PM_{2.5}$	0.025	0.035	0.16	0.02	0.50	0.78	4.9
PM_{10}	0.05	0.06	0.3	0.02	0.37	0.80	2.7
SO_2	0.04	0.05	0.5	0.03	0.66	3.92	7.8
CO	4.0	3.0	5.0	1.25	0.42	77.83	15.6
NO_2	0.01	0.04	0.2	0.06	1.5	1.91	9.6
NO	N/A	0.06	0.4	0.06	0.97	1.00	2.5

Notes:
[a] World Health Organisation. (2021). *WHO global air quality guidelines*. Retrieved from https://www.who.int/europe/publications/i/item/9789240034228
[b] Sanitary and Epidemiological Requirements for Maximum Permissible Concentrations of Pollutants in Ambient Air of Urban and Rural Settlements (Appendix 1 to the order of the Minister of Health of the Republic of Kazakhstan dated 2 August 2022 No. ҚР ДСМ-70).
[c] Maximum Permissible Concentration for Daily Average are the maximum allowable concentrations of pollutants averaged over a 24-hour period.
[d] Maximum Permissible Concentration for Maximum One-Time Release are the maximum allowable concentration of pollutants that can be present in the air which does not cause, when inhaled for 20-30 minutes, any reflex reactions in a human body.

[57] Kazhydromet. (2023). Monthly newsletter on the state of the environment for 2023. Retrieved from https://www.kazhydromet.kz/en/ecology/ezhemesyachnyy-informacionnyy-byulleten-o-sostoyanii-okruzhayuschey-sredy/2023

The 2023 background concentrations of key air pollutants in Almaty City were in compliance with local regulations for MPC_{DA} with the exception of PM (dust) and NO_2. The 2023 background concentrations of key air pollutants in Almaty City were all in exceedance against the local standards for MPC_{MNR} as well as the 2021 WHO Global Air Quality Guidelines. It should be noted that the air quality data for Almaty City may not accurately reflect the Project area as majority of the Project is located on land primarily used for agriculture, unlike the urban nature of Almaty City, and the Project is located 20km north of Almaty City.

The nearest settlement to the alignment for which episodic air quality monitoring data[58] by Kazhydromet is conducted is the village of Otygen Batyr (approximately 15km South of the project towards Almaty). The data for this settlement are provided in **Table 6-4**.

TABLE 6-4: MAXIMUM CONCENTRATIONS OF POLLUTANTS ACCORDING TO EPISODIC OBSERVATIONS IN THE VILLAGE OF OTEGEN BATYR BY KAZHYDROMET

Pollutants	**Episodic Ambient Air Quality MPC_{MNR} at Otygen Batyr**			
	Monitoring Station No. 1		Monitoring Station No. 2	
	mg/m³	MPC_{MNR} exceedance, times	mg/m³	MPC_{MNR} exceedance, times
$PM_{2.5}$	0.18	1.15	0.22	1.38
PM_{10}	0.31	1.04	0.32	1.07
SO_2	0.00	0.00	0.00	0.00
CO	13.90	2.80	5.30	1.10
NO_2	0.00	0.00	0.00	0.00
Phenols	0.02	2.30	0.01	1.10
Formaldehyde	0.00	0.00	0.00	0.00
H_2S	0.02	2.40	0.03	4.00

Source: Kazhydromet. (2023). *Monthly newsletter on the state of the environment for 2023*. Retrieved from https://www.kazhydromet.kz/en/ecology/ezhemesyachnyy-informacionnyy-byulleten-o-sostoyanii-okruzhayuschey-sredy/2023

In 2023, there were exceedances against local air quality standards in MPC_{MNR} for both air quality monitoring stations at Otygen Batyr village for the pollutants $PM_{2.5}$, PM_{10}, CO, phenols and H_2S.

The National EIA conducted air dispersion modelling for construction and operation sources of emissions as detailed in **Appendix C**. The National EIA used baseline conditions for the winter/summer period of the year from Kazhydromet. According to the letter of the national

[58] In addition to stationary observation posts, a mobile environmental laboratory operates in Almaty, with the help of which ambient air quality measurements are additionally carried out at 10 points: in Talgar (2 points), Esik (2 points), Turgen (2 points), Otegen Batyr (2 points), and Kaskelen (2 points). We additionally use this data, since there are no other sources of air quality for various pollutants for the project area.

hydrometeorological service "Kazhydromet"[59], due to the lack of ambient air quality monitoring at Zhana Arna, Moyinkum, Sorbulak, and Kazybek Bek Stations and Zhetygen village, issuing the background ambient air pollutant concentrations was not possible. The background ambient air quality concentrations used in the National EIA was taken in accordance with RD 52.04.189-89 for cities with different population sizes as presented in **Table 6-5**.

TABLE 6-5: BACKGROUND POLLUTANT CONCENTRATION FOR CITIES WITH DIFFERENT POPULATION SIZES BY KAZHYDROMET (IN ACCORDANCE WITH RD 52.04.189-89)

City population, in thousands	PM (Dust)	SO_2	NO_2	CO
250-125	0.4	0.05	0.03	1.5
125-50	0.3	0.05	0.015	0.8
50-10	0.2	0.02	0.008	0.4
<10	0	0	0	0

Since the populations of Zhana Arna, Kazybek Bek, Sorbulak and Moyinkum stations are less than 10,000 people each, air dispersion calculations in the National EIA were carried out without considering background concentrations. Since the population of Zhetygen Station is 25,000 people, air dispersion calculations in the National EIA were carried out considering background concentrations. The air dispersion modelling findings from the National EIA are summarised in the next section and in **Table 6-9**.

The National EIA did not conduct baseline ambient air quality monitoring. According to secondary opensource data presented above the air basin of the project area can be considered as degraded by most parameters, given the poor air quality in the city of Almaty (the project is located 20km from the northern border of Almaty), as well as taking into account episodic observations in populated areas around Almaty (Otygen Batyr village located 15km south of the Project) and data from a previous publicly disclosed project in the vicinity (BAKAD project[60]).

6.2.3.1 SITE VISIT OBSERVATIONS

During ERM’s site visits, some impacts on air quality associated with the project activities were noted:

- During ERM’s Reconnaissance visit from 23 September – 4 October 2024, dust clouds at construction sites were observed. This impact is related to insufficient frequency/thoroughness of road watering (Project embedded controls) used by construction vehicles.
- Construction machinery and vehicles to strictly follow designated temporary access routes and adhere to speed limits on access roads without hard surfacing as during ERM’s site visit from 28 October – 8 November 2024, this practice was not observed to be followed.

[59] This letter was mentioned in the National EIA.
[60] European Bank for Reconstruction and Development. (n.d.). BAKAD road concession project. Retrieved from https://www.ebrd.com/work-with-us/projects/esia/bakad-road-concession-project.html

6.2.4 POTENTIAL SOURCES OF IMPACTS

The full list of emission sources during construction and operation phases from the National EIA is presented in **Appendix C**. Based on the potential impacts assessed, the emission sources from the National EIA were mostly scoped out. The following main types of impacts were identified as relevant to the Project:

- Dust emissions[61] during construction activities such as earthworks.
- Construction traffic arising due to vehicles accessing construction sites. This traffic will principally be Heavy Goods Vehicles (HGVs). Construction traffic will arise throughout the Project alignment, focused principally on the larger construction sites (e.g. stations, depot) and construction compounds. Construction traffic is of limited timeframe.
- Operational traffic arising due to vehicles accessing stations. This traffic will principally be Light Commercial and Private Vehicles (LDVs), such as cars and taxis, accessing the station. As there is no data available on the connection of the stations with existing bus-lines or other public transport, these impacts have not been assessed.

Summary of permissible emissions[62] during the construction and operation phase from the National EIA are presented below in **Table 6-6**, **Table 6-7** and **Table 6-8**.

TABLE 6-6: SUMMARY OF PERMISSIBLE EMISSIONS DURING THE CONSTRUCTION AND INSTALLATION PHASE

Station / Area	Permissible emission rate, g/s	Maximum permissible emissions, tons
Zhana Arna Station	7.3	94.2
Zhetygen Station	5.8	49.3
Kazybek Bek Station	5.7	15.0
Substation Alma	3.5	2.3
Reclamation of quarries at Zhana Arna Station	0.5	3.4
Reclamation of quarries at Kazybek Bek Station	0.5	3.0
Zhana Arna Station - Zhetygen Station	4.2	5.4
Zhetygen Station №1 LPG Storage Park	2.2	0.2
Zhetygen Station №2 LPG Storage Park	2.3	0.1
Zhetygen Station №3 LPG Storage Park	2.0	0.2
Moyinkum Station - Zhana Arna Station	3.8	44.8
Reclamation of quarries on the section Zhana Arna Station - Zhetygen Station	0.5	62.0

[61] Construction activities such as land clearance and infrastructure construction works were scoped out as the sources were considered variable.
[62] Maximum permissible emissions are the total emission of a pollutant into the atmosphere from all sources of a given enterprise and the dispersion of emissions in the atmosphere, provided that emissions of the same substance from sources do not create a ground concentration exceeding the MPC. This includes following pollutants: CO, Hydrocarbons, NO_2, SO_2, Black carbon, Acrolein, Formaldehyde and Benz(a)pyrene

Station / Area	Permissible emission rate, g/s	Maximum permissible emissions, tons
Reclamation of quarries on the section Zhana Arna Station - Moyinkum Station	0.5	30.3
Reclamation of quarries at the distillation of St. Kazybek Bek – Sorbulak Station	0.5	32.8
Reclamation of quarries on the distillation of Sorbulak Station - Moyinkum Station	0.5	55.5
Sorbulak Station - Moyinkum Station	0.3	0.4
Kazybek Bek Station – Sorbulak Station	0.2	0.1
Moyinkum Station	5.3	13.1
Sorbulak Station	7.5	91.7
Total	52.6	503.8

TABLE 6-7: VOLUME OF EMISSIONS FROM GAS VENTING[63] AT THE INTERSECTION OF THE BYPASS RAILWAY WITH THE MAIN GAS PIPELINE OWNED BY AGP LLP DURING CONSTRUCTION PHASE

Name[64]	Permissible emission rate, g/s	Maximum permissible emissions, tons
Thread "A" (section #1)	89959.8	1403.4
Thread "B" (section #1)	89959.8	1403.4
Thread "C" (section #1)	115400.2	2216.0
Thread "A" (section #2)	89537.2	1396.8
Thread "B" (section #2)	89537.2	1396.8
Thread "C" (section #2)	83940,567.0	1611,6624.0

TABLE 6-8: SUMMARY OF PERMISSIBLE EMISSIONS DURING THE OPERATIONS PHASE

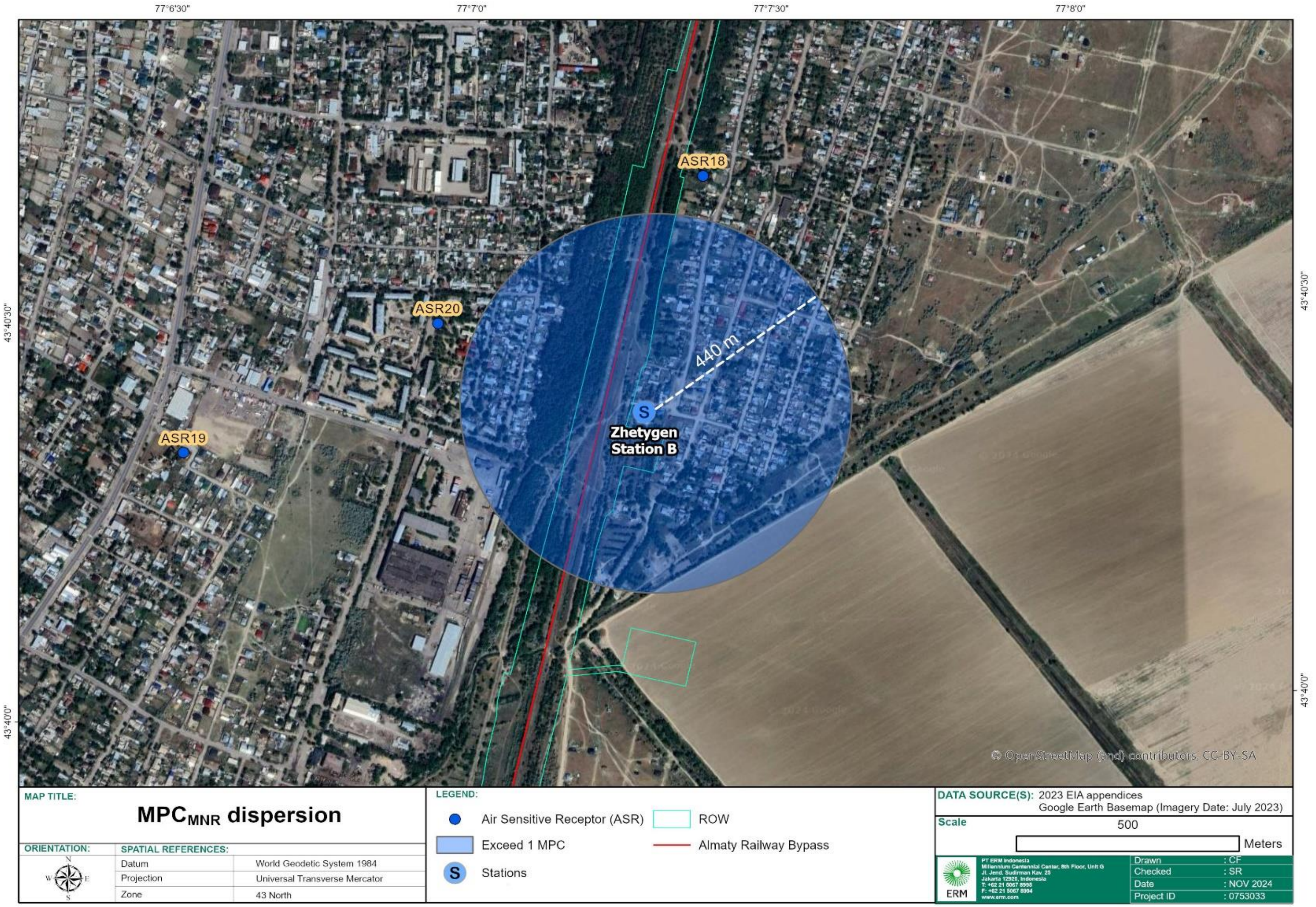
Name	Permissible emission rate, g/s	Maximum permissible emissions, tons
Zhana Arna Station	2.5	6.0
Kazybek Bek Station	1.2	3.8
Zhetygen Station	9.0	38.8
Total	12.6	48.6

[63] According to ERM's January 2025 Site Clarifications Excel, the gas venting is a one-time event during the construction phase. The existing natural gas pipeline will be shut off for 30 days during construction before being reinstalled/reconnected with upgraded sections of the gas pipeline. The gas built up in the existing main pipelines will need to be vented as summarised in the table.
[64] According to ERM's January 2025 Site Clarifications Excel, threads A, B and C refer to three branches of the main natural gas pipeline.

According to the National EIA, air dispersion modelling results showed that in the construction area the concentrations of pollutants emitted by pollution sources do not exceed the established sanitary standards for all parameters without taking into account background concentrations of pollutants. The National EIA stated that the establishment of a SPZ was not required for construction work, since the construction is temporary, and pollutant emissions are limited to the construction period according to the 2022 Sanitary and Epidemiological Requirements for Establishing Sanitary Protection Zones (SPZ) of Production Facilities, Order No. KR DSM-2.

However, in the National EIA appendices for air dispersion results, there were MPC exceedances during construction for dust, black carbon, NO and NO_2 from a radius of 100m and outwards as presented in **Table 6-9**. The closest residential receptors seen from publicly available maps did not align with those presented in the National EIA appendices. When the MPC_{MNR} dispersion contours for Zhetygen Station from the National EIA appendices were compared against satellite maps, the MPC exceedances within a radius of 440m showed residential buildings that were not presented in the National EIA appendices (**Figure 6-2**). There were no SO_2 dispersion results for construction and operation phases presented in the National EIA appendices as well.

FIGURE 6-2: MPC_{MNR} EXCEEDANCES AT ZHETYGEN STATION FROM THE NATIONAL EIA



For the operational phase, the dispersion modelling results from the National EIA show that MPCs will not be exceeded for any of the air pollutants. The results of the dispersion calculations indicate that during operations, the Project belongs to category II – facilities with a negative impact on the environment as per the 2021 Environmental Code of the Republic of Kazakhstan No. 400-VI ZRK (National EIA). The Project was assigned sanitary hazard class – IV, which establishes a sanitary gap of width not less than 100m (installed from the axis of the outermost railway track).

TABLE 6-9: MAXIMUM ONE-TIME MPC_{MNR} EXCEEDANCES BASED ON DISPERSION MODELLING RESULTS FROM THE NATIONAL EIA

Modelling point name	Air pollutants	Average radius of excess of 1 MPC_{MNR}, m
Railway section Kazybek Bek Station - Sorbulak Station	NO	220
	NO_2	220
	Black carbon	120
Construction of Kazybek Bek Station[65]	Dust	50
Construction of Zhetygen Station	Dust	440
Quarries reclamation at railway section Kazybek Bek Station - Sorbulak Station	NO	220
	NO_2	220
	Black carbon	100
Construction of Alma Substation	Dust	150
Construction of Sorbulak Station	NO	150
	NO_2	200
Railway section Sorbulak Station – Moyinkum Station	NO	220
	NO_2	220
Quarries reclamation at railway section Sorbulak Station – Moyinkum Station	NO	220
	NO_2	220
Construction of Moyinkum Station	NO	260
	NO_2	280
Railway section Moyinkum Station – Zhana Arna Station	NO	300
	NO_2	310
Quarries reclamation at railway section Zhana Arna Station - Moyinkum Station	NO	200
	NO_2	200
Construction of Zhana Arna Station	Dust	600
	Dust	200

[65] The dust dispersion contour maps for the construction of the Kazybek Bek Station was not presented in the National EIA appendices. ERM received email correspondence from InTech on 22 December 2024 to clarify the MPC exceedance data.

Modelling point name	Air pollutants	Average radius of excess of 1 MPC_{MNR}, m
Quarries reclamation at Zhana Arna Station	NO_2 + SO_2	350
Quarries reclamation at Kazybek Bek Station	NO_2 + SO_2	400
Railway section Zhana Arna Station – Zhetygen Station	NO	200
	NO_2	200
Quarries reclamation at railway section Zhana Arna Station - Zhetygen Station	NO	200
	NO_2	220
Zhetygen Station LPG Storage Park No. 1	NO	300
	NO_2	350
Zhetygen Station LPG Storage Park No. 2	NO	200
	NO_2	210
Zhetygen Station LPG Storage Park No. 3	NO	100
	NO_2	220
Source: Appendix with dispersion modelling results from the National EIA.		

The National EIA air dispersion modelling assessment has the following limitations:

- The closest residential receptors seen from publicly available maps did not align with those presented in the National EIA appendices. When the MPC_{MNR} dispersion contours for Zhetygen Station from the National EIA appendices were compared against satellite maps, the MPC exceedances within a radius of 440m showed the presence of residential buildings that were not indicated in the National EIA appendices (**Figure 6-2**).
- There was no construction and operation phase SO_2 dispersion contour maps available in the National EIA appendices with no explanation for the omission.
- There were missing construction dust pollutant contour maps for part of the project facilities in the National EIA appendices with a lack of explanation for their omission.
- The MPC_{MNR} exceedances indicated in the contour maps in the National EIA appendices were not indicated in the main National EIA report.
- Overall, the National EIA provided insufficient details in its assessment and explanation of the permissible emissions. The emissions calculations data were presented in detail in the National EIA, however the impact assessment was inadequately described. Furthermore, the assessment of air dispersion modelling in the National EIA was also lacked sufficient detailed explanations.

Clarifications were attained via ERM’s email correspondence with InTech and the applicable explanations were included in this section. Resultantly, the Project construction and operation air quality assessments were assessed as described below.

6.2.5 ASSESSMENT CRITERIA

6.2.5.1 RECEPTOR SENSITIVITY

The sensitivity of human receptors to the health effects of dust and traffic exhaust follows the same guidance (IAQM, 2024) as impact magnitude. The guidance stated that dust arising from construction activities would normally re-deposit within 250m from the source. The sensitivity criteria adopted for this assessment are presented in **Table 6-10**.

TABLE 6-10: CLASSIFICATION OF RECEPTOR SENSITIVITY TO CONSTRUCTION OPERATIONS (IAQM, 2024)

Sensitivity	Description
Low	Locations where the enjoyment of amenity would not reasonably be expected; or property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. Indicative examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.
Medium	Locations where users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or the appearance, aesthetics or value of their property could be diminished by soiling; or the people or property wouldn’t reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. Indicative examples include parks and places of work.
High	Locations where users can reasonably expect enjoyment of a high level of amenity; or the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. Indicative examples include dwellings, museums and other culturally important collections, medium and long term car parks and car showrooms.

6.2.5.2 DUST IMPACTS

Impact Magnitude

The assessment focuses on the dust during site preparation and construction phase. Guidance on the assessment of dust from demolition and construction[66] from United Kingdom is adopted for this assessment. The guidance defines impact significance arising from construction worksites based on the scale and nature of the construction works and are outlined in **Table 6-11** below.

[66] Institute of Air Quality Management (IQAM). (2024). Construction dust guidance (January 2024). Retrieved from https://iaqm.co.uk/wp-content/uploads/2013/02/Construction-Dust-Guidance-Jan-2024.pdf

TABLE 6-11: IMPACT MAGNITUDE FOR ASSESSMENT OF DUST IMPACTS

Magnitude of Impacts	**Definitions**
Negligible	• No demolition or building construction works; or • Earthworks: • Total site area <500m^2; • Soil type with large grain size (e.g. sand).
Small	• Demolition: • Total building volume <120,000m^3; • Construction material with low potential for dust release, e.g. metal cladding, timber; and/or • Demolition activities undertaken <6 m above ground level • Construction: • Total building volume <12,000m^3; and/or • Construction material with low potential for dust release, e.g. metal cladding, timber. • Earthworks: • Total site area 500m^2 to 18,000m^2 • Soil type with large grain size (e.g. sand); and • <5 heavy earth moving vehicles active at any one time.
Medium	• Demolition: • Total building volume 12,000 – 75,000m^3; • Construction material with potential for dust release; and/or • Demolition activities undertaken 6 - 12m above ground level. • Construction: • Total building volume 12,000 – 75,000m^3; • Potentially dusty construction material e.g. concrete; and/or • On site concrete batching. • Earthworks: • Total site area 18,000m^2 to 110,000m^2; • Moderately dusty soil type (e.g. silt); and • 5 -10 heavy earth moving vehicles active at any one time.
Large	• Demolition: • Total building volume >75,000m^3; • Potentially dusty construction material e.g. concrete; • On site crushing and screening; and/or • Demolition activities undertaken > 12 m above ground level. • Construction: • Total building volume >75,000m^3; • On site concrete batching and sandblasting. • Earthworks: • Total site area >110,000m^2; • Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size); and • >10 heavy earth moving vehicles active at any one time.

6.2.5.3 CONSTRUCTION AND OPERATION TRAFFIC EXHAUST MAGNITUDE

Overview of Impacts

Impacts are anticipated to arise due to:

- Construction traffic arising due to vehicles accessing construction sites. This traffic will principally be Heavy Goods Vehicles (HGVs). Construction traffic will arise throughout the Project alignment, focused principally on the larger construction sites (e.g. stations, depot) and construction compounds. Construction traffic is of limited timeframe.
- Operational traffic arising due to vehicles accessing stations. This traffic will principally be Light Commercial and Private Vehicles (LDVs), such as cars and taxis, accessing the station. As there is no data available on the connection of the stations with existing bus-lines or other public transport, these impacts have not been assessed.

As no traffic data is available, the methodology is based instead upon the numbers of vehicles needed hypothetically to trigger impacts based upon an increase in roadside NO_2 and PM_{10}, noting that NO_2 is the more sensitive parameter for road traffic.

a. Model Overview and Inputs

Modelling of construction and operation traffic emissions has been undertaken by ERM utilising the ADMS-Roads dispersion model for the Project. ADMS uses information on the traffic flows, traffic speeds, road characteristics, surrounding area and local meteorology to predict the impacts of road traffic emissions on air quality.

ADMS is one of the small number of dispersion models that is specifically designed for use in assessing road traffic impacts and is mentioned as an acceptable model in the IFC EHS Guidance67. The model has been extensively verified and is accepted by the Environment Agency for England, whose model guidance is accepted and extensively used to underpin IFC modelling best practice.

As no traffic data was available for the assessment, a conceptual model was created to understand the potential impacts from construction and operational traffic. The model is designed to understand how many HGVs and LDVs would be needed to trigger significant impacts on different types of roads used by Project-related traffic. In line with the conceptual approach, receptors are defined as being 10m, 25m, 50m and 100m from the centre of each conceptual road to give indicative impacts.

Outputs from the model can be compared with the significance criteria defined above to assess the potential impacts along the Project route. The model inputs and approach are set out in **Table 6-12**.

TABLE 6-12: ADMS-ROADS DISPERSION MODEL INPUTS

Parameter	Approach	Notes
Dispersion model	CERC ADMS-Roads v5.0	CERC ADMS 5 is an internationally recognised model for road modelling.
Model domain	Conceptualised 1km stretch of road going North to South (0,0 to 0,1000m)	-

[67] International Finance Corporation (IFC). (2007). Environmental, health, and safety guidelines: Air emissions and ambient air quality. Retrieved from https://www.ifc.org/wps/wcm/connect/4e01e089-ad1a-4986-b955-e19e1f305ff0/1-1%2BAir%2BEmissions%2Band%2BAmbient%2BAir%2BQuality.pdf?MOD=AJPERES&CVID=ls0KF2J

Parameter	Approach	Notes
Roads Modelled	2 lane urban road (HGVs only) 2 lane urban road (LDVs only) 4 lane urban road (HGVs only) 4 lane urban road (LDVs only) 4 lane rural highway (HGVs only) 4 lane rural highway (LDVs only)	The conceptualised road is modelled as these road types with associated road widths, speeds and vehicle numbers. HGVs were analysed to assess construction traffic. LDVs were analysed to assess operational traffic.
Road widths	2 lane urban road: 8m 4 lane urban road: 16m 4 lane rural highway: 20m	Assumed road widths
Speeds	2 lane urban road: 30km/hr 4 lane urban road: 30km/hr 4 lane rural highway: 120km/hr	Speeds based on standard speeds for those type of roads.
Vehicles per hour	100, 200, 300, 400 and 500	Estimated numbers to provide PM_{10}/NO_2 concentration vs. traffic count
Receptors	10m, 25m, 50m and 100m from centre of road east and west (every 100m along the road)	Receptors are conceptualised defined to allow visualisation of results.
Surface characteristics at dispersion site	Surface Roughness: 0.5 Albedo: 0.23 Monin-Obhukov Length: 30 Priestly–Tailor Parameter: 1	-
Meteorological data	2023, Almaty, Kazakhstan	Hour-sequential data
Street Canyons	None	The roads are assumed to be not confined by street canyons
Emissions data	Road traffic emissions were calculated based upon 2017 England Rural composition data as part of the ADMS-Roads 5 model.	No traffic emissions data was identified for Almaty. This dataset was used as an approximation of worst-case Almaty scenario.

Source: ERM, 2025.

6.2.6 IMPACT ASSESSMENT

6.2.6.1 RECEPTOR SENSITIVITY

Air sensitive receptors (ASRs) are defined as people or environmental areas that are most vulnerable to changes in air quality. Potential ASRs include residential areas, and areas where groups of people may be expected to congregate for extended periods of time (i.e. construction labour camps, operational employee housing, parks/ recreational areas, cemeteries, hospitals and schools). **Table 6-13** lists the ASRs which were identified for this study.

The sensitivity of ASRs is assigned based on an evaluation that incorporates an understanding of the likely exposure duration, taking account of ASR type and age (see **Table 6-13**). Typically, the sensitivity for human health for construction workers in rotational camps is **Low**, **Medium** for the general population, while that of children, the elderly and sick is **High**.

The areas surrounding the Project footprint are predominantly agricultural plots and residential areas at Kazybek Bek village and Alatau City. During construction phase, dust from construction activities is typically re-deposited within 250m of the source (IAQM, 2024). The sections of the alignment excluding the stations pass through areas where there are mainly receptors of low sensitivity i.e. farmland. At the stations within settlements, there are mainly receptors of medium sensitivity i.e. Alatau City and Kazybek Bek residential premises, hospitals, mosques and cemeteries. The nearest residential premises is located 20m north of the Project at Kazybek Bek village. At Kazybek Bek village, there are two receptors of high sensitivity i.e. schools.

The receptor sensitivity at Kazybek Bek station is evaluated to be **High**. The receptor sensitivity at Sorbulak, Moyinkum, Zhana Arna and Zhetygen stations is evaluated to be **Medium**. The receptor sensitivity at sections of the alignment between stations (i.e. excluding the stations) is evaluated to be **Low**.

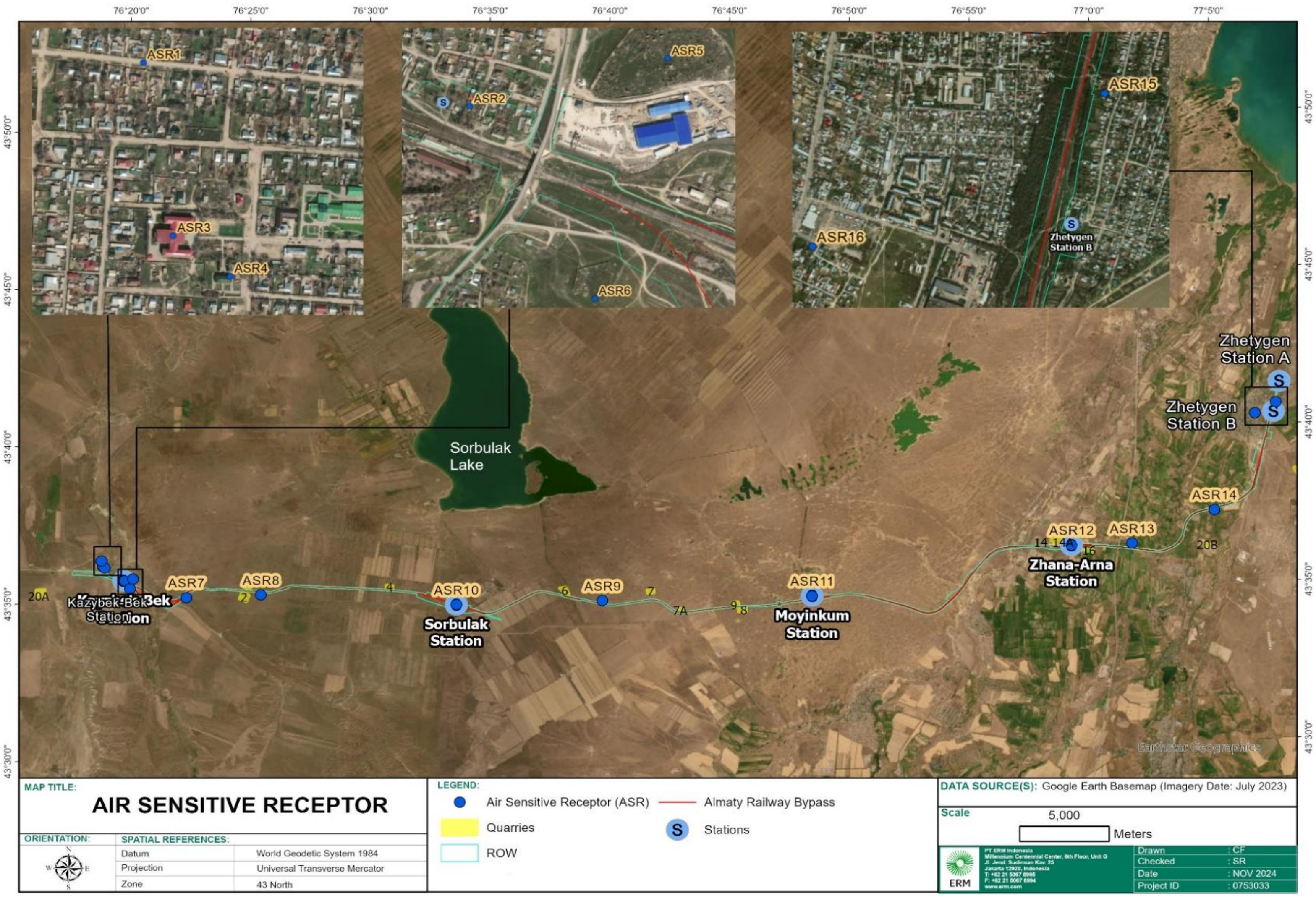
TABLE 6-13: LIST OF AIR SENSITIVE RECEPTORS (ASRS)

No.	Receptor name	Land use	Receptor sensitivity	Approximate distance and orientation from alignment	
ASR1	Kazybek Bek village	Residential	Medium	20m	North
ASR2	Residential housing for employees at Kazybek Bek Station	Residential	Medium	15m	North
ASR3	Srednyaya Shkola Stantsii, Kazybek Bek	School	High	240m	North
ASR4	Sadik Pre-school, Kazybek Bek	School	High	210m	North
ASR5	Unnamed cemetery, near Kazybek Bek	Cemetery	Medium	200m	North
ASR6	Unnamed Christian cemetery, near Kazybek Bek	Cemetery	Medium	120m	South
ASR7	Farmland and residential, near Kazybek Bek (Coordinates: 43°35'8.00"N, 76°21'53.00"E)	Residential, farmland	Low	185m	Southeast
ASR8	Farmland and residential, near Kazybek Bek (43°35'10.80"N, 76°24'59.20"E)	Residential, farmland	Low	35m	South

No.	Receptor name	Land use	Receptor sensitivity	Approximate distance and orientation from alignment	
ASR9	Farmland and residential, near Sorbulak Station (43°34'48.24"N, 76°39'10.85"E)	Residential, farmland	Low	190m	North
ASR10	Residential housing for employees at Sorbulak Station	Residential	Medium	Adjacent to alignment	
ASR11	Residential housing for employees at Moyinkum Station	Residential	Medium	Adjacent to alignment	
ASR12	Residential housing for employees at Zhana Arna Station	Residential	Medium	Adjacent to alignment	
ASR13	Alatau City [a]	Residential	Medium	165m	North
ASR14	Farmland and residential, near Zhetygen Station (43°37'17.44"N, 77° 4'42.71"E)	Residential, farmland	Low	80m	South
ASR15	Residential housing for employees at Zhetygen Station	Residential	Medium	Adjacent to alignment	
ASR16	Alatau City [b]	Residential	Medium	45m	West

Notes:
[a] Located at an area of the newly established Alatau city that was once Zhana Arna village. On 9 January 2024, Zhana Arna was officially integrated into the newly established city of Alatau, which was formerly known as Zhetygen.
[b] Located at an area of the newly established Alatau city that was once Zhetygen village. On 9 January 2024, Zhetygen was granted city status and renamed Alatau.
Source: The Astana Times. (2024, January). *Kazakhstan welcomes new town Alatau*. The Astana Times. Retrieved from https://astanatimes.com/2024/01/kazakhstan-welcomes-new-town-alatau/

FIGURE 6-3: AIR SENSITIVE RECEPTOR (ASR) MAP OF THE PROJECT AREA



6.2.6.2 CONSTRUCTION PHASE DUST

Embedded Controls

The following construction control measures from the National EIA include:

- Mandatory compliance of equipment, construction processes and operations with national laws and regulations.
- Construction activities, movement of machinery and equipment, storage and handling of materials in areas not designated by the project are prohibited.
- Dust suppression by watering of open construction sites during earthworks and bulk construction materials.
- Construction machinery and vehicles to strictly follow designated temporary access routes and adhere to speed limits on access roads without hard surfacing.
- Ensure soil, waste and sludge are covered during transport by vehicles.
- Elimination of open storage, loading, and transportation of bulk loose materials. Instead, containers or specialised transport shall be used.
- All preparatory and installation work will be carried out within a limited project area where appropriate.
- Site cleanup and landscaping to restore vegetation cover after construction is completed.
- All construction quarries will be backfilled with vegetation planted and areas with disturbed soil and vegetation will be restored to limit exposed soil surfaces and dust pollution after the completion of construction. Perennial grass will be sowed on the surface of fertile soil with mineral fertiliser added.

Impact Magnitude

Based on the potential impacts assessed, the emission sources from the National EIA were mostly scoped out. The impacts from construction dust were identified as relevant to the Project as mentioned in **Section 6.2.5.2**.

Earthworks is stated to have large dust emission magnitude when the site has a total site area greater than 110,000m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), more than 10 heavy earth moving vehicles active at any one time, and formation of bunds greater than 6m in height. During construction, the Project estimates a total earthworks volume of 6,221,608m^3 or 8,971,559 tonnes and a site footprint approximately 1,033.08 hectares or 10,330,800m^2. Thus, the dust emissions magnitude was assessed to be Large which is in line with the high risk of dust nuisance arising. Given that there is a high risk of dust nuisance, with the embedded controls, the impact magnitude is assessed as **Small**, at worst. We have applied this magnitude criteria as the Project will have earthworks at construction sites, bridges and quarries that contribute to dust emissions.

Impact Significance

- For Kazybek Bek station: Based on the **High** air receptor sensitivity and **Small** dust emissions magnitude, the Impact Significance was evaluated as **Moderate**.

- For Sorbulak, Moyinkum, Zhana Arna and Zhetygen stations: Based on the **Medium** air receptor sensitivity and **Small** dust emissions magnitude, the Impact Significance was evaluated as **Minor**.
- For sections of the alignment between the stations: Based on the **Low** air receptor sensitivity and **Small** dust emissions magnitude, the Impact Significance was evaluated as **Negligible**.

Mitigation Measures

In addition to embedded controls described above, the following mitigation measures are required to reduce potential impacts at Kazybek Bek Station and are recommended good practice at other stations and along the alignment:

- Develop air quality management plan to capture the embedded controls, additional mitigation measures and monitoring requirements. Further details can be found in the Project ESMP (**Section 8**).
- Dust suppression by watering of open construction sites during earthworks and bulk construction materials to minimise airborne PM at a greater frequency than currently practiced must be adhered to. During the warm season, watering should be done every four (4) hours (including in the morning before starting work and at the end of the day). On particularly hot, dry and windy days, watering should be done every two (2) hours according to the recommendations of the IFC EHS Guidelines. Visual checks should be undertaken and if needed, additional dust suppression added as required if visible dust blow is obvious form any activity.
- Construction machinery and vehicles to strictly follow designated temporary access routes and adhere to speed limits on access roads without hard surfacing must be adhered to. The project should prepare a Traffic Management Plan if traffic flows are potentially significant (as determined by the screening values provided) with responsibilities and monitoring of compliance, further details can be found in the Project ESMP (**Section 8**) and Construction ESMS (separate file).
- Mulch or cover areas of occasional or no construction traffic within the sites.

Summary

The impact significance for air quality due to the construction phase dust is summarised in **Table 6-14.**

TABLE 6-14: IMPACT SIGNIFICANCE OF CONSTRUCTION PHASE DUST ON AIR QUALITY

Category	Impact before Mitigation	Residual Impact
Nature	Negative	
Type	Direct	
Duration	Short-term	
Extent	Local	
Scale	• Stations: Nearest residential premises located 20m north of the Project at Kazybek Bek village. • Alignment (excluding stations): Nearest farmland and residential premises located 35m south of the alignment.	

Category	Impact before Mitigation	Residual Impact
Frequency	Construction works for 24 months.	
Kazybek Bek Station significance	**Moderate**	**Minor**
Other stations significance	**Minor**	**N/A**
Alignment significance	**Negligible**	**N/A**

6.2.6.3 CONSTRUCTION PHASE TRAFFIC EXHAUST EMISSIONS

Embedded Controls

The following construction control measures from the National EIA include:

- Mandatory compliance of fuels, materials, products, equipment, construction processes and operations with national laws and regulations.
- During periods of adverse meteorological conditions[68], KTZ is required to implement temporary measures to reduce pollutants emitted into the atmosphere. Upon receiving a notification from Kazhydromet, the following measures will be implemented.
  - First mode: Measures should reduce the ground-level pollutant concentrations by approximately 15 – 20%.
    - Enhancing control over technological processes[69].
    - Limiting high-emission activities[70].
    - Performing wet cleaning of places where workers are located within safety regulations.
  - Second mode: Measures should reduce the ground-level pollutant concentrations by approximately 20 – 40%.
    - Implement all first mode measures.
    - Restricting vehicle movement on site.
    - Slightly reduce the efficiency and operation of units and technological lines associated with the release of comparatively greater concentrations of harmful pollutants.
    - If scheduled repair work coincides with this mode, the equipment repair should be stopped.
  - Third mode: Measures should reduce the ground-level pollutant concentrations by approximately 40 – 60%

[68] According to the legislation of Kazakhstan, adverse meteorological conditions (AMC) are special combinations of meteorological factors and synoptic situations that contribute to the accumulation of harmful (polluting) substances in the surface layer of atmospheric air. Such conditions include calm, light wind, fog and inversion, which prevent the dispersion of pollutants and lead to their accumulation in the atmosphere. The National Hydrometeorological Service of Kazakhstan informs the population about AMC.
[69] For example, inspections of the progress of construction work will be strengthened to prevent any unplanned emissions of air pollutants.
[70] These activities were not identified from the National EIA. From ERM's Almaty January 2025 Site Clarifications Excel, KTZ and Integra stated that construction activities identified were from heavy vehicles and equipment. However, further details and details on operation activities were unavailable.

  - Implement all first and second mode measures.
  - Reduce the load or completely stop processes associated with the release of comparatively greater concentrations of harmful pollutants.
- Construction machinery and vehicles to strictly follow designated temporary access routes and adhere to speed limits on access roads without hard surfacing.
- Prohibit unnecessary idling of vehicle engines and construction machinery within parking areas and work sites.

Impact Magnitude

Based on the potential impacts assessed, the emission sources from the National EIA were mostly scoped out. The impacts from construction HGV traffic exhaust were identified as relevant to the Project as mentioned in the section above.

Construction traffic was assessed on the basis that HGVs would be travelling to the site on three (3) types of road: a two-lane urban road; a four-lane urban road; and a rural highway. Conceptual modelling of construction traffic emissions was undertaken utilising the ADMS-Roads dispersion model as described in the section above.

The tables below indicate the potential number of vehicles per hour required to result in significant impacts on air quality at receptors at the given distances from the road and considering areas with undegraded airshed and with degraded airsheds. For instance, **Table 6-15** indicates that, for two-lane urban roads, in an undegraded airshed, if a receptor is located within 10m of the road, up to 440 heavy goods vehicles (HGVs) per hour would result in a 10% (negligible) magnitude. Four-lane urban road and rural highway's results are summarised in **Table 6-16** and **Table 6-17** respectively.

The approach is highly conceptual, as the actual road conditions, receptor locations, traffic flows etc. are unknown. These data are therefore provided as an indication of the scale of traffic that would need to be generated to create potentially significant impacts, and are not definitive. On the basis that the assessment is highly conceptual, the recommendation is made that vehicle counts are undertaken around the larger and longer duration construction activities to verify whether traffic increases could result in moderate or major significant impacts.

These traffic flows can be considered as the thresholds of significant impacts. Impacts are, naturally, greater with higher traffic flows and receptors closer to the roadside. Furthermore, where the airshed is degraded, the receptors have a greater sensitivity, so fewer vehicles are required to trigger Minor/Moderate/Major impacts.

TABLE 6-15: CONSTRUCTION: TWO-LANE URBAN ROAD

		Distance from the Road, Number of HGVs/hour			
		10m	25m	50m	100m
Magnitude		Undegraded Airshed			
10%	Negligible	440	850	1,230	2,490
25%	Small	1,100	2,120	3,080	6,230
75%	Medium	3,300	6,370	9,260	18,700

		Distance from the Road, Number of HGVs/hour			
		10m	25m	50m	100m
>75%	Large	>3,300	>6,370	>9,260	>18,700
Magnitude		Degraded Airshed			
5%	Negligible	220	425	620	1240
10%	Small	440	850	1230	2490
25%	Medium	1,100	2,120	3,080	6,230
>25%	Large	>1,100	>2,120	>3,080	>6,230

TABLE 6-16: CONSTRUCTION: FOUR-LANE URBAN ROAD

		Distance from the Road, Number of HGVs/hour			
		10m	25m	50m	100m
Magnitude		Undegraded Airshed			
10%	Negligible	380	810	1,240	2540
25%	Small	950	2,025	3,100	6350
75%	Medium	2,850	6,075	9,300	19,050
>75%	Large	>2,850	>6,075	>9,300	>19,050
Magnitude		Degraded Airshed			
5%	Negligible	190	405	620	1,270
10%	Small	380	810	1,240	2,540
25%	Medium	950	2,025	3,100	6,350
>25%	Large	>950	>2,025	>3,100	>6,350

TABLE 6-17: CONSTRUCTION: RURAL HIGHWAY

		Distance from the Road, Number of HGVs/hour			
		10m	25m	50m	100m
Magnitude		Undegraded Airshed			
10%	Negligible	455	960	2,890	5,840
25%	Small	1,140	2,410	7,220	14,600
75%	Medium	3,410	7,220	21,600	43,800
>75%	Large	>3,410	>7,220	>21,600	>43,800
Magnitude		Degraded Airshed			
5%	Negligible	230	480	1,440	2,920

		Distance from the Road, Number of HGVs/hour			
		10m	25m	50m	100m
10%	Small	455	960	2,890	5,840
25%	Medium	1,140	2,410	7,220	14,600
>25%	Large	>1,140	>2,410	>7,220	>14,600

In reality, the magnitude of risk for all three (3) roads is likely to be **Negligible** to **Small**, as there are unlikely to be the levels of traffic generated the reach the threshold for Medium impacts in any scenario.

In reality, the magnitude of risk for all three (3) roads at Sorbulak, Moyinkum, Zhana Arna and Zhetygen stations and along the alignment is likely to be **Negligible to Small** as there are unlikely to be the levels of traffic generated the reach the threshold for Medium impacts in any scenario. This cannot be completely ruled out for some locations where there are large quantities of rock being moved, but for most of the route this is unlikely to occur. The magnitude of risk for all three roads specific to the high sensitivity ASRs (i.e. schools) near Kazybek Bek Station is likely to be **Negligible** due to the distance exceeding 200m.

Impact Significance

- For Kazybek Bek station: Based on the **High** air receptor sensitivity and **Negligible** impact magnitude, the Impact Significance was evaluated as **Negligible**.
- For Sorbulak, Moyinkum, Zhana Arna and Zhetygen stations: Based on the **Medium** air receptor sensitivity and **Negligible** to **Small** impact magnitude, the Impact Significance was evaluated as **Negligible** to **Minor**.
- For sections of the alignment between the stations: Based on the **Low** air receptor sensitivity and **Negligible** to **Small** impact magnitude, the Impact Significance was evaluated as **Negligible**.

Mitigation Measures

No additional mitigation measures required. The following are recommended good practice:

- Regularly carry out preventive engine maintenance of construction machinery and vehicles. Recommendations according to IFC EHS Guidelines, US EPA and ISO 14001:
  - Heavy Equipment (e.g. Excavators, Dozers): Every 250-500 hours of operation (or every 3-6 months) depending on operating conditions.
  - Light Vehicles: Every 5,000-10,000km or as recommended by the manufacturer.
- Carry out regular engine exhaust tests for construction machinery and motor vehicles (at least annual scheduled tests and after every engine overhaul or adjustment). Recommendations according to IFC EHS Guidelines, US EPA and ISO 14001:
  - Annual Testing: At least once a year for all construction equipment.
  - After Engine Repair or Adjustment: Emissions testing is mandatory after major engine repairs, component replacements or calibrations.
  - Heavy Duty: Under heavy loads, testing every six (6) months is recommended.

- Do not use machinery/vehicles, which were not subject to technical inspection and exhaust gases testing. Appoint a responsible person to monitor the technical readiness of the contractors' and the Company's machinery/vehicles for construction work.

Summary

The impact significance for air quality due to construction phase traffic exhaust is summarised in **Table 6-18**.

TABLE 6-18: IMPACT SIGNIFICANCE OF CONSTRUCTION TRAFFIC EXHAUST ON AIR QUALITY

Category	Impact before Mitigation	Residual Impact
Nature	Negative	
Type	Direct	
Duration	Long-term	
Extent	Regional	
Scale	Nearest residential premises are located 20m north of the Project at Kazybek Bek village.	
Frequency	Continuous (traffic emissions will arise throughout construction)	
Kazybek Bek Station significance	**Negligible**	**N/A**
Other stations significance	**Negligible to Minor**	**N/A**
Alignment Significance	**Negligible**	**N/A**

6.2.6.4 OPERATIONAL PHASE TRAFFIC EXHAUST EMISSIONS

Embedded Controls

The following operational embedded controls from the National EIA include:

- Prohibit unnecessary idling of vehicle engines within parking areas.

Impact Magnitude

Based on the potential impacts assessed, the emission sources from the National EIA were mostly scoped out. The impacts from construction LDV traffic exhaust were identified as relevant to the Project as mentioned in the section above.

The operation of the bypass is assumed to be 30 – 50 years as stated in **Section 2.2**. The main emission sources will be operational traffic arising due to vehicles accessing stations.

Operational traffic was assessed on the basis that LDVs would be travelling to the stations using: two-lane urban roads; four-lane urban roads; and four lane rural highways. As with construction traffic, operational traffic was modelled conceptually as described in **Section 6.2.5.3**. **Table 6-19**, **Table 6-20** and **Table 6-21** show the number of vehicles per hour required to create a significant effect on air quality in an area with undegraded airshed and an area with degraded airsheds.

For operational traffic it was noted that the greatest change in pollutant levels per change in vehicle number took place for NO_2 (annual), so this was considered the worst case out of each pollutant.

TABLE 6-19: OPERATIONS – TWO-LANE ROAD

		Distance from the Road, Number of LDVs/hour			
		10m	25m	50m	100m
Significance		Undegraded Airshed			
10%	Negligible	540	1,090	2,060	4,210
25%	Small	1,340	2,730	5,150	10,500
75%	Medium	4,030	8,190	15,400	31,600
>75%	Large	>4,030	>8,190	>15,400	>31,600
Magnitude		Degraded Airshed			
5%	Negligible	270	550	1,030	2,100
10%	Small	540	1,090	2,060	4,210
25%	Medium	1,340	2,730	5,150	10,500
>25%	Large	>1,340	>2,730	>5,150	>10,500

TABLE 6-20: OPERATIONS – FOUR-LANE ROAD

		Distance from the Road, Number of LDVs/hour			
		10m	25m	50m	100m
Significance		Undegraded Airshed			
10%	Negligible	490	1,070	2,050	4,220
25%	Small	1,220	2,680	5,130	10,600
75%	Medium	3,670	8,040	15,400	31,700
>75%	Large	>3,670	>8,040	>15,400	>31,700
Significance		Degraded Airshed			
5%	Negligible	245	540	1,030	2,110
10%	Small	490	1,070	2,050	4,220
25%	Medium	1,220	2,680	5,130	10,600
>25%	Large	>1,220	>2,680	>5,130	>10,600

TABLE 6-21: OPERATIONS – RURAL HIGHWAY

		Distance from the Road, Number of LDVs/hour			
		10m	25m	50m	100m
Significance		Undegraded Airshed			
10%	Negligible	320	740	1420	2915
25%	Small	800	1840	3540	7290
75%	Medium	2410	5530	10600	21900
>75%	Large	>2410	>5530	>10600	>21900
Significance		Degraded Airshed			
5%	Negligible	160	370	710	1460
10%	Small	320	740	1420	2915
25%	Medium	800	1840	3540	7290
>25%	Large	>800	>1840	>3540	>7290

In reality, the impact magnitude for all three roads at Sorbulak, Moyinkum, Zhana Arna and Zhetygen stations and along the alignment is likely to be **Negligible to Small** as the population sizes around the stations are small and the Project is considered unlikely to generate sufficient traffic to reach the threshold for a Medium impact. The impact magnitude for all three roads specific to the high sensitivity ASRs (i.e. schools) near Kazybek Bek Station is likely to be **Negligible** due to the distance exceeding 200m. The Project should undertake a vehicle count survey around Kazybek Bek station before and at the start of the operation phase and undertake a screening exercise to verify this assumption.

Impact Significance

- For Kazybek Bek station: Based on the **High** air receptor sensitivity and **Negligible** impact magnitude, the Impact Significance was evaluated as **Negligible**.
- For Sorbulak, Moyinkum, Zhana Arna and Zhetygen stations: Based on the **Medium** air receptor sensitivity and **Negligible** to **Small** impact magnitude, the Impact Significance was evaluated as **Negligible** to **Minor**.
- For sections of the alignment between the stations: Based on the **Low** air receptor sensitivity and **Negligible** to **Small** impact magnitude, the Impact Significance was evaluated as **Negligible**.

Mitigation Measures

The following are recommended mitigation measures near Kazybek Bek station:

- Baseline and quarterly air quality monitoring of parameter NO_2 at the ASRs (i.e. schools) in Kazybek Bek village.
- KTZ to undertake vehicle counts around Kazybek Bek Station before and during the start of the operations phase and undertake a screening exercise once this survey data is known. As part of the screening exercise, identify if there will be any need for mitigation measures.

Summary

The impact significance for air quality due to operations phase traffic exhaust is summarised in **Table 6-22**.

TABLE 6-22: IMPACT SIGNIFICANCE OF OPERATIONS TRAFFIC EXHAUST ON AIR QUALITY

Category	**Impact before Mitigation**	**Residual Impact**
Nature	Negative	
Type	Direct	
Duration	Long-term	
Extent	Regional	
Scale	Nearest residential premises are located 20m north of the Project at Kazybek Bek village.	
Frequency	Continuous (operational emissions will arise throughout project lifetime)	
Kazybek Bek Station Significance	**Negligible**	**Negligible**
Other Stations Significance	**Negligible to Minor**	**N/A**
Alignment Significance	**Negligible**	**N/A**

6.3 NOISE AND VIBRATION

6.3.1 INTRODUCTION

This section provides an assessment of the current noise and vibration environment and evaluates the potential impacts of the Project on nearby noise sensitive receptors (NSRs). Given that noise and vibration are inherent byproducts of both construction and operational activities, their magnitude, frequency, and duration have been carefully analysed using the latest available data provided by KTZ. This assessment aims to identify potential exceedances of regulatory thresholds, determine receptor sensitivity, and outline appropriate mitigation measures to minimise noise impacts and facilitate compliance with environmental noise standards.

As the Project is on-going, the noise assessment was prepared based on the following limitations:

- Due to limited available information, certain assumptions regarding rail operation and construction were made during this impact assessment. Refer to the individuals impact sections for assumptions.
- Noise propagation can be influenced by factors such as wind speed, temperature, humidity, and existing noise sources, making it challenging to isolate project-related noise impacts.
- Construction noise estimates are based on assumptions of construction equipment, and the actual equipment used on-site may differ, affecting the accuracy of the assessment.
- Future modifications to the operational schedule or equipment replacements could alter the predicted noise impacts.

6.3.2 APPLICABLE REFERENCE FRAMEWORK

Applicable noise and vibration related laws, directives, policies and guidelines are outlined below.

TABLE 6-23: NOISE APPLICABLE REGULATIONS AND GUIDELINES

Title	Year
Law	
Environmental Code of the Republic of Kazakhstan No. 212	2007
Sanitary and Epidemiological Requirements for Sanitary Protection Zones of Facilities that Impact the Environment and Human Health, No. 26447	2022
Guidance	
International Finance Corporation. Environmental, Health, And Safety (EHS) Guidelines. General EHS Guidelines: Environmental	2007
International Finance Corporation. Environmental, Health, And Safety (EHS) Guidelines for Railways	2007
International Finance Corporation. Environmental, Health, And Safety (EHS) Guidelines for Construction Materials Extraction	2007
World Health Organisation Guidelines for Community Noise	1999

Title	Year
World Health Organisation Environmental Noise Guidelines for the European Region	2018
Transit Noise and Vibration Impact Assessment Manual (Report 0123), United States Federal Transit Administration (USFTA)	2018
Euro-Asian Council for Standardization, Metrology and Certification (EASC) GOST 23337-2014 Methods of noise measurement in residential areas and in residential and public buildings. (Regional Standard)	2014
EASC GOST 31297-2005 Noise Technical method for determining the sound power levels of industrial enterprises with multiple noise sources to assess the sound pressure levels in the environment	2005
GN "Hygienic Noise and Infra-Sound Levels in Rooms of Residential and Public Buildings and at the Residential Areas" (approved by order of the Minister of health of the Republic of Kazakhstan dated 3 December 2004 No. 841	2004
British Standard BS 5228: Noise and Vibration Control on Construction and Open Sites	2014

6.3.2.1 NOISE LIMITS

This section outlines the noise limits to be used for assessing (i) construction and (ii) operational noise, following the standards and guidelines mentioned above.

The noise limits specified in the WBG General EHS Guidelines and National Standards do not specifically address the noise thresholds or assessing noise impacts of either construction or railway operational noise. In line with IFC PS3 paragraph 5[71], alternative GIIP has been selected and justified in this section.

United States Federal Transit Administration - Transit Noise and Vibration Impact Assessment Manual (USFTA Guidelines)[72] provides a more appropriate and internationally recognised framework specifically for railway projects, offering reliable assessment methodology consistent with the objectives of PS3 for evaluating both construction and operational railway noise impacts.

(i) Construction Noise

The national standards and WBG General EHS Guidelines do not specify quantitative limits for construction noise. Effective construction noise criteria should consider the existing noise

[71] The client will refer to the EHS Guidelines or other internationally recognized sources, as appropriate, when evaluating and selecting resource efficiency and pollution prevention and control techniques for the project. The EHS Guidelines contain the performance levels and measures that are normally acceptable and applicable to projects. When host country regulations differ from the levels and measures presented in the EHS Guidelines, clients will be required to achieve whichever is more stringent. If less stringent levels or measures than those provided in the EHS Guidelines are appropriate in view of specific project circumstances, the client will provide full and detailed justification for any proposed alternatives through the environmental and social risks and impacts identification and assessment process. This justification must demonstrate that the choice for any alternate performance levels is consistent with the objectives of this Performance Standard.

[72] Volpe, J. A. (2020, February 27). *Transit Noise and Vibration Impact Assessment Manual*. Transit Noise and Vibration Impact Assessment Manual (Report 0123). https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf

environment, the absolute noise levels during construction, the duration of the construction activities, and the surrounding land uses.

The residential day and night-time construction noise limits are referenced from the USFTA guidelines as summarised in **Table 6-24.** For the assessment of construction noise at sensitive receptors, the construction noise limit under the Residential category is utilised.

TABLE 6-24: USFTA - CONSTRUCTION NOISE LIMITS

	Construction Noise Limits $L_{eq,equip(1hr)}$, dBA	
	Daytime (07:00-22:00)	Nighttime (22:00-07:00)
Residential	**90**	**80**
Commercial	100	100
Industrial	100	100

Reference: USFTA (2018) - Table 7-2 General Assessment Construction Noise Criteria

(ii) Operational Noise

The WBG General EHS Guidelines 1.7 Noise is an internationally recognised guideline document containing information for the assessment and management of noise, in which it distinguishes between two main receptor categories: residential and industrial, as outlined in **Table 6-25**. The guidelines address noise from facilities and stationery sources, and are commonly used as design standards for industrial facilities. While they may suggest thresholds for noise effects in a general sense, in several disclosed ESIAs[73,74], alternative noise thresholds have been subsequently adopted.

Noise Limits for Train Stations

Train station noise sources primarily originate from stationary equipment that operates continuously, such as ventilation systems, air conditioning units, lighting, and other support machinery. Since the equipment generate consistent noise over extended periods, they contribute to the overall noise environment at the station. Given the continuous nature of these noise sources, the noise limits set by the WBG EHS Guidelines, as well as the national standards from General Note "Hygienic Noise and Infra-Sound Levels in Rooms of Residential and Public Buildings and at the Residential Areas", should be adhered to in order to ensure that noise levels remain within acceptable limits.

The noise level guidelines under both WBG General EHS Guidelines and national standards establish identical $L_{Aeq(1hour)}$ limits of 55 dBA during daytime and 45 dBA at nighttime for residential, institutional, and educational receptors. However, unlike the WBG General EHS

[73] CFB MUA Technical Committee. (2017). *Environmental and social impact assessment (ESIA) for the CFB rail extension project from Sangaredi to Kamsar, Guinea: Final report*. ERM.
[74] MIGA. (2016, September). *Gaziantep Integrated Health Campus: Environmental and social impact assessment.* Multilateral Investment Guarantee Agency. https://www.miga.org/sites/default/files/2023-02/Vol%20I_Gaziantep_Final_September%202016.pdf. ERM.

Guidelines, national standards also include L_{max} (Maximum Sound Level) limits, which represent the highest instantaneous noise level recorded within a given measurement period.

The limits in **Table 6-25** shall be applicable for the noise assessment of train stations operation which estimates the noise contribution from mechanical and electrical equipment to nearest residential area. The noise impacts should not exceed the levels presented in **Table 6-25**, or result in a maximum increase in background levels of 3 dB at the nearest residential receptor location off-site.

TABLE 6-25: NATIONAL AND WBG GENERAL EHS NOISE LIMITS

	Noise Limits			
	Daytime (0700-2200)		Nighttime (2200-0700)	
	$L_{Aeq(1hour)}$, dBA	L_{max}, dBA	$L_{Aeq(1hour)}$, dBA	L_{max}, dBA
National Standards[75]	55	70	45	60
WBG General EHS Guidelines[76]	55	-	45	-

Noise Limits for Operational Noise from Railway

1. WBG General EHS Guidelines and National Noise Limits

As mentioned above, the WBG General EHS Guidelines are generic and not specific for the assessment of transport or mobile noise sources and national noise limits are designed to assess impacts from continuous noise sources, such as industrial plants, HVAC systems, and factories. These sources create constant and continuous noise levels, which are evaluated using thresholds that consider these characteristics.

In contrast, railway noise is:

- Intermittent – Trains pass by, creating brief, high-energy noise events followed by quiet periods .
- Highly variable – Different train types, speeds, track configurations, and times of day affect noise levels .
- More tolerable to communities – People generally adapt better to predictable, intermittent noise (like a train that follows a set schedule) than to constant background noise (like a factory running continuously) based on researches by the German UBA[77] and Japan's rail agencies[78], which has demonstrated that communities report lower annoyance levels for railway noise compared to continuous noise sources at equivalent dB levels.

2. World Health Organisation (WHO) Guidelines

[75] "Hygienic Noise and Infra-Sound Levels in Rooms of Residential and Public Buildings and at the Residential Areas" (2004). Approved by the Decree of the Minister of Health of the Republic of Kazakhstan No. 841, 3 December 2004, Annex 1.
[76] Or 3 dB above background noise levels as per IFC guidelines.
[77] Umweltbundesamt (UBA). (n.d.). *Railway noise and its effects on people*. German Federal Environmental Agency. https://www.umweltbundesamt.de/en
[78] Japan Ministry of Land, Infrastructure, Transport and Tourism (MLIT). (n.d.). *Railway noise impact and community adaptation studies*. MLIT Japan. https://www.mlit.go.jp

WHO guidelines for Community Noise indicated for outdoor living area, serious annoyance at daytime and evening time is at 55dBA[79]. Railway Noise in Europe by International Union of Railways in 2016 indicated the following:

> *"For railway lines with nightly freight traffic, it would be impossible to reach these levels within reasonable distance from the track, unless high noise barriers and in some cases tunnels and complete covers of the track would be installed"*.

In 2018, WHO published environmental noise guidelines "Environmental noise guidelines for the European Region[80]". It contains specific railway noise criteria to prevent adverse health effects and is based on ten (10) community annoyance studies involving surveys of 10,970 individuals exposed to railway noise. The document notes the following:

> *"Different noise sources – for example, road traffic noise and railway noise – can be characterized by different spectra, different noise level rise times of noise events, different temporal distributions of noise events and different frequency distributions of maximum levels. Because of the extensive differences in the characteristics of individual noise sources, these guidelines only consider sources specific exposure–response functions (ERFs) and, therefore, formulate only source-specific recommendations."*

Based on it above, it is ERM's recommendation that railway noise-specific criteria be used for this assessment and not be conflated with generic WBG EHS criteria which is commonly applied as design standards for industrial facilities.

3. Other Internationally Recognised Criteria

Agencies such as the USFTA, Transport Canada, and the German Federal Environmental Agency (UBA) have developed criteria that specifically address railway noise characteristics. While the USFTA is primarily used in the United States, some other countries adopt similar methodologies for assessing railway noise, here are a few examples:

- Canada – Transport Canada and local transit agencies often reference USFTA methodologies particularly for major rail projects. The Canadian Railway Noise Guidelines (2013) align with FTA method in assessing intermittent noise impacts using Sound Exposure Level (SEL) and Day-Night Average Sound Level (Ldn).
- Australia – The New South Wales (NSW) Environmental Protection Authority (EPA) uses SEL-based assessments, similar to USFTA guidelines, when evaluating railway noise in urban settings.
- United Kingdom, Germany, Japan – These countries have developed their specific railways noise methodologies but some studies in these countries had also compared and referenced to USFTA.

[79] Fiumicelli, D., & Triner, N. (n.d.). *World Health Organization (WHO) guidelines for community noise: A help or a hindrance?* Institute of Acoustics. https://www.ioa.org.uk/system/files/proceedings/d_fiumicelli_n_triner_world_health_organisation_who_guidelines_for_community_noise_-_a_help_or_a_hin.pdf
[80] World Health Organization. (2018). *Environmental noise guidelines for the European Region*. https://www.who.int/europe/publications/i/item/9789289053563

These examples indicate that while many countries have their own noise regulations, some adopt USFTA similar methodologies or reference USFTA noise assessment techniques for transit and rail projects, especially when dealing with intermittent noise sources like trains. Therefore, the railway operational noise impact assessment is conducted following USFTA Guideline.

Referencing from Rail Infrastructure Noise Guideline from the New South Wales Government[81], the airborne noise levels for rail operation in different countries are compared. The WBG EHS noise limits typically set 55 dBA during the day and 45 dBA at night for residential areas. In comparison, many countries' rail noise guidelines allow higher noise levels, particularly for operational railways. For example, in the US, the acceptable range for railway noise is 52-65 dBA during the day, while Australia and European countries like Switzerland set thresholds between 60-70 dBA for daytime, with higher allowances at night, reflecting less stringent standards than those outlined in the WBG EHS guidelines.

4. Justification for USFTA Guideline

As mentioned above, noise limits specified in the WBG General EHS Guidelines and National Standards do not have specific criteria for railway noise.

Referencing from the disclosed Environmental Impact Assessment of "India: Chennai Metro Rail Investment Project Corridor 4"[82] in 2022 and "India: Nagpur Metro Urban Mobility Project"[83] in 2024:

> *"FTA criteria for noise impact were developed specifically for transit noise sources operating on fixed-guideways in urban areas. These criteria are based on well-documented research on human response to community noise and represent a reasonable balance between community benefit and project costs. The criteria at which the levels of impact occur are presented in two ways depending on the relationship of project and existing noise sources"*.

In accordance with IFC PS3 paragraph 5, alternative GIIP for this assessment shall be selected and justified. Based on the reasons presented above, the USFTA Guideline provides an appropriate and internationally recognised framework for railway noise assessment and has been selected as performance levels established for operational rail noise are considered consistent with the objectives of PS3. The land use category and description under USFTA Guideline are summarised in **Table 6-26** below and the Noise Levels Defining Impact for Transit Projects from Option A criteria are outlined in **Table 6-27** below.

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81 New South Wales Environment Protection Authority. (2012). *Rail infrastructure noise guideline*. https://www.environment.nsw.gov.au/resources/noise/20120057railnoisedrgl.pdf

82 Asian Development Bank. (2022). *India: Chennai Metro Rail Investment Project: Corridor 4 Updated Environmental Impact Assessment*. Asian Development Bank. https://www.adb.org/sites/default/files/project-documents/52234/52234-001-eia-en_23.pdf

83 Asian Development Bank. (2024). *India: Nagpur Metro Urban Mobility Project Environmental Impact Assessment*. Asian Development Bank. https://www.adb.org/sites/default/files/project-documents/56297/56297-001-eia-en_12.pdf

TABLE 6-26: LAND USE CATEGORY AND METRICS FOR TRANSIT NOISE IMPACT CRITERIA

Land Use Category	Land Use Type	Noise Metric, dBA	Description
1	High Sensitivity	Outdoor Leq(1hr)	Land where quiet is an essential element of its intended purpose.
2	Residential	Outdoor Ldn	This category is applicable all residential land use and buildings where people normally sleep, such as hotels and hospitals.
3	Institutional	Outdoor Leq(1hr)	This category is applicable to institutional land uses with primarily daytime and evening use.

TABLE 6-27: USFTA - RAILWAY OPERATION NOISE CRITERIA

Existing Noise Exposure, dBA	Project Noise Impact Exposure, dBA					
	Category 1 ($L_{eq(1hr)}$) or 2 (L_{dn}) Sites			Category 3 Sites ($L_{eq(1hr)}$)		
$L_{eq(1hr)}$ or L_{dn}	No Impact	Moderate Impact	Severe Impact	No Impact	Moderate Impact	Severe Impact
<43	< Ambient+10	Ambient +10 to 15	> Ambient+15	< Ambient+15	Ambient +15 to 20	> Ambient+20
43	<52	52-58	>58	<57	57-63	>63
44	<52	52-58	>58	<57	57-63	>63
45	<52	52-58	>58	<57	57-63	>63
46	<53	53-59	>59	<58	58-64	>64
47	<53	53-59	>59	<58	58-64	>64
48	<53	53-59	>59	<58	58-64	>64
49	<54	54-59	>59	<59	59-64	>64
50	<54	54-59	>59	<59	59-64	>64
51	<54	54-60	>60	<59	59-65	>65
52	<55	55-60	>60	<60	60-65	>65
53	<55	55-60	>60	<60	60-65	>65
54	<55	55-61	>61	<60	60-66	>66
55	<56	56-61	>61	<61	61-66	>66
56	<56	56-62	>62	<61	61-67	>67
57	<57	57-62	>62	<62	62-67	>67
58	<57	57-62	>62	<62	62-67	>67
59	<58	58-63	>63	<63	63-68	>68
60	<58	58-63	>63	<63	63-68	>68
61	<59	59-64	>64	<64	64-69	>69
62	<59	59-64	>64	<64	64-69	>69
63	<60	60-65	>65	<65	65-70	>70
64	<61	61-65	>65	<66	66-70	>70
65	<61	61-66	>66	<66	66-71	>71
66	<62	62-67	>67	<67	67-72	>72
67	<63	63-67	>67	<68	68-72	>72
68	<63	63-68	>68	<68	68-73	>73
69	<64	64-69	>69	<69	69-74	>74
70	<65	65-69	>69	<70	70-74	>74
71	<66	66-70	>70	<71	71-75	>75
72	<66	66-71	>71	<71	71-76	>76
73	<66	66-71	>71	<71	71-76	>76
74	<66	66-72	>72	<71	71-77	>77
75	<66	66-73	>73	<71	71-78	>78
76	<66	66-74	>74	<71	71-79	>79
77	<66	66-74	>74	<71	71-79	>79
>77	<66	66-75	>75	<71	71-80	>80

Reference: USFTA (2018) - Table 4-5 Noise Levels Defining Impact for Transit Projects
Note:

- No Impact - Project-generated noise is not likely to cause community annoyance. Noise projections in this range are considered acceptable by FTA and mitigation is not required.
- Moderate Impact - Project-generated noise in this range is considered to cause impact at the threshold of measurable annoyance. Moderate impacts serve as an alert for potential adverse impacts and complaints from the community. Mitigation should be considered at this level of impact based on project specifics and details concerning the affected properties.
- Severe Impact - Project noise in this range can cause strong community annoyance. If avoiding noise impacts isn't possible, mitigation measures should be considered.

National Sanitary Rule (2022)

The establishment of the Sanitary Protection Zone (SPZ) is governed by the Sanitary Rules titled "Sanitary and Epidemiological Requirements for Sanitary Protection Zones of Facilities Impacting the Environment and Human Health," approved by Order No. KR DSM-2 of the Acting Minister of Health of the Republic of Kazakhstan, dated 11 January 2022. These rules impose several restrictions on land use within the SPZ boundaries, including limitations on residential buildings for new stations and/or expansions.-Even though there are no national criteria on railway noise levels, a SPZ is required according to Appendix 2 Paragraph 9 of the Sanitary Rule. It states that residential developments must be separated from newly constructed railways by sanitary gaps of at least 100m, measured from the axis of the outermost railway track. If the railway is placed in a trench or if special noise protection measures are implemented to ensure compliance with hygienics standards, the width of the sanitary gap may be reduced to 50m. The sanitary gap to the boundaries of garden plots should be at least 50m.

6.3.2.2 VIBRATION LIMITS

The national standards and WBG General EHS Guidelines do not provide specific quantitative limits for construction vibration. Similar to noise limits in the previous section, to ensure conformity of the noise assessment, the vibration assessment for both construction and operation are referenced from the USFTA Guideline.

Construction Vibration

To evaluate the impact of construction-related vibrations, the predicted vibration levels are compared against the building construction vibration damage criteria outlined in the USFTA Guideline. It is important to note that neither the national standard nor IFC guidelines specify limits for construction vibration. Therefore, the Category III limits from the USFTA Guideline have been adopted as the reference vibration criteria for this assessment. The building/structural category list and the corresponding PPV limits are shown in **Table 6-28,** noting that the residential buildings, as per ERM's observations, are predominantly constructed of non-engineered timber and masonry.

TABLE 6-28: USFTA - CONSTRUCTION VIBRATION DAMAGE CRITERIA ON BUILDING

Building / Structural Category	PPV, in/sec	Approximate L_v, VdB re 1 micro-inch /sec
I. Reinforced-concrete, steel or timber (no plaster)	0.5	102
II. Engineered concrete and masonry (no plaster)	0.3	98
III. Non-engineered timber and masonry buildings	**0.2**	**94**
IV. Buildings extremely susceptible to vibration damage	0.12	90
Reference: USFTA (2018) - Table 7-5 General Assessment Construction Noise Criteria		

In addition to potential building damage, vibration can also impact human comfort or cause annoyance. A summary of subjective human responses to varying levels of ground-borne vibration is provided in **Table 6-29**.

TABLE 6-29: USFTA - HUMAN RESPONSE TO GROUND-BORNE VIBRATION

Vibration Velocity Level	Human Response
65 VdB	Approximate threshold of perception for many humans.

Vibration Velocity Level	Human Response
75 VdB	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find transit vibration at this level annoying.
85 VdB	Vibration tolerable only if there are an infrequent number of events per day.

Reference: USFTA (2018) - Table 5-5 Human Response to Different Levels of Ground-Borne Vibration and Noise

Operational Vibration

Neither the WBG EHS General Guidelines nor the national standards specify ground-borne vibration limits. Therefore, the vibration limits are referenced from the USFTA Manual are summarised in **Table 6-30.**

Residential areas are classified under Category 2, and the USFTA limits will be used to assess the predicted operational vibration from train movements. The category of 'Occasional Events' is applicable as a total of 54 train passbys in both directions per day is expected.

TABLE 6-30: GROUND-BORNE VIBRATION IMPACT CRITERIA

Land Use Category	GBV Impact Levels, VdB re 1 micro-inch /sec		
	Frequent Events	Occasional Events	Infrequent Events
Category 1: Buildings where vibration would interfere with interior operations.	65	65	65
Category 2: Residences and buildings where people normally sleep.	72	**75**	80
Category 3: Institutional land uses with primarily daytime use.	75	78	83

Note: Frequent events – more than 70 events per day, occasional events – 30-70 events per day, infrequent events – fewer than 30 events per day
Reference: USFTA (2018) - Table 6-3 Indoor Ground-Borne Vibration (GBV) and Ground-Borne Noise (GBN) Impact Criteria for General Vibration Assessment

6.3.3 NATIONAL EIA

National EIA report by InTech LLP in 2023 was taken and assessed to develop this noise assessment. Construction noise and operation noise from train stations were assess, the results are summarised below.

6.3.3.1 CONSTRUCTION NOISE

In Section 7.5 of the National EIA, the noise from construction and operation phases were assessed. According to the sanitary rules "Sanitary and epidemiological requirements for Sanitary Protection Zones (SPZ) of facilities that are objects of impact on the environment and human health" approved by the order of the Acting Minister of Health of the Republic of Kazakhstan dated 11 January 2022 No KR DSM-2, the establishment of a SPZ is not required for construction work, since the construction is temporary, and noise emissions are limited to the construction period.

To summarise, based on the construction noise attenuation calculations, the noise arising from construction work to the environment is deemed insignificant. The National EIA did not include an estimation of construction noise levels. As there was no quantitative assessment for construction noise in the National EIA, ERM had conducted the construction noise assessment in this Supplementary ESIA in **Section 6.3.6.1**.

6.3.3.2 OPERATIONAL NOISE

As for operational noise, the SPZ at Sorbulak, Moyinkum and Zhana Arna Stations are determined. According to Appendix 2 of the Environmental Code of the Republic of Kazakhstan No. 400-VI ZRK (Section 2, Clause 5, Subclause 5.4), the stations are classified as a Category II facilities due to the potential negative environmental impacts. The size of sanitary gap shall be not less than 100m-299m as the hazard class IV is established for the facilities.

The SPZ for the three (3) stations are provided in the National EIA as:

- Sorbulak Station – 100-191m
- Moyinkum Station – 6-100m
- Zhana Arna Station – 9-100m

It is noted that residential areas are not found within 100m from the above stations, there shall be no impact to any sensitive receptor around these stations.

6.3.3.3 NOISE FROM TRAIN STATIONS

Operational noise from train stations is accounted for in the National EIA. The noise model includes outdoor noise sources, such as noise-generating mechanical and electrical equipment at the stations, to predict noise levels in the surrounding areas. The assessment methodology outlined in the National EIA is replicated in **Section 6.3.5.4.**

6.3.3.4 VIBRATION

The assessment of vibration is included in Section 11.1 in the National EIA. While quantitative assessment for vibration is not conducted, mitigations measures for construction and operational vibration are included in the section and summarised in the embedded controls sections.

6.3.4 EARLY-STAGE CONDITIONS

The National EIA did not include baseline noise measurements, which are essential for accurately evaluating the potential noise impacts of the Project. Without this data, it is not possible to determine the existing noise levels in the area or to assess how the Project may alter the ambient sound environment.

To address this gap, an ambient noise profile must be established through on-site noise monitoring. This process involves conducting noise measurements at key locations representative of the project area, considering factors such as time of day and existing noise sources (e.g., traffic, industry, natural sounds). The collected data will serve as a reference point, allowing for a more precise comparison between current noise conditions and projected noise levels once the Project is operational.

By integrating on-site noise monitoring into the assessment, the study will provide a more robust and data-driven evaluation of potential noise impacts, ensuring compliance with applicable noise limits while enabling the implementation of effective mitigation measures if needed.

ERM had conducted the baseline noise monitoring according to the E&S Early-stage Data Collection Memo Final[84] dated 21 November 2024. The selected locations are representative of the residential settlements and other land uses in the area. The standardised methodology and justification for GIIP are detailed in **Section 7.3.2.1**.

6.3.4.1 STANDARD METHODOLOGY AND GUIDELINES

The assessment of noise within the Project area included the measurement of the equivalent (L_{Aeq}) and maximum noise level ($L_{MAX(5\text{-}min)}$) in accordance with the national regulatory requirements (**GOST 23337-78** Methods of noise measurement in residential areas and in residential and public buildings and **GOST 31297-2005** Noise - Technical method for determining the sound power levels of industrial enterprises with multiple noise sources to assess the sound pressure levels in the environment).

USFTA Guidelines Appendix E outlines various methods for determining existing noise levels. For residential receptors, a full 24-hour measurement is recommended to accurately assess ambient noise and obtain L_{dn}. However, due to site constraints—such as limited accessibility and unstable weather—conducting a continuous 24-hour measurement is not feasible. As an alternative, *Option 4: Computation of L_{dn} from 1 partial $L_{eq(1hr)}$ measurement (residential)* is adopted. This approach allows L_{dn} to be computed from a measured $L_{Aeq(1hr)}$ value, provided this parameter is incorporated into the assessment. In summary, to establish existing noise conditions, noise measurements shall be conducted for at least one hour ($L_{eq(1\text{-}hr)}$) during both daytime and nighttime periods.

ERM considers the one-hour noise measurement representative of the residential settlement noise environments crossed by the Project. The measurement was conducted during typical railway operational hours with generic resident activities nearby. This approach aligns with industry best practices, ensuring a realistic assessment of potential impacts by capturing noise during typical activity periods. Additionally, the measurement locations were selected to better understand the major noise sensitive receptors in the area (mainly residential settlements near Zhetygen and Kazybek Bek). As a result, the one-hour measurement provides a robust snapshot of the existing noise environment, adequately reflecting the variations in noise levels that occur across the Project's scope.

6.3.4.2 BASELINE METHODOLOGY

Ambient noise levels in any given geographic area are influenced by a combination of natural and human-made sources. The prevailing noise environment is shaped by factors such as the density and type of infrastructure, transportation networks, industrial activities, and natural soundscapes.

In the study area, baseline ambient noise conditions were assessed to establish reference levels before project implementation. This assessment considers both existing noise sources and their temporal variations, providing a benchmark against which potential project-related noise impacts can be evaluated.

[84] The “E&S Early-stage Data Collection Memo Final” included the baseline environmental methodology of data collection.

To assess background noise levels at each sampling location, the acoustic instrumentation used throughout the monitoring program meets the requirements of IEC 61672 "Class 1 Sound Level Meter" with an A-weighting response curve. The Sound Level Meter was calibrated on field prior and after completion of noise measurement. The data logging interval was set at 10 seconds.

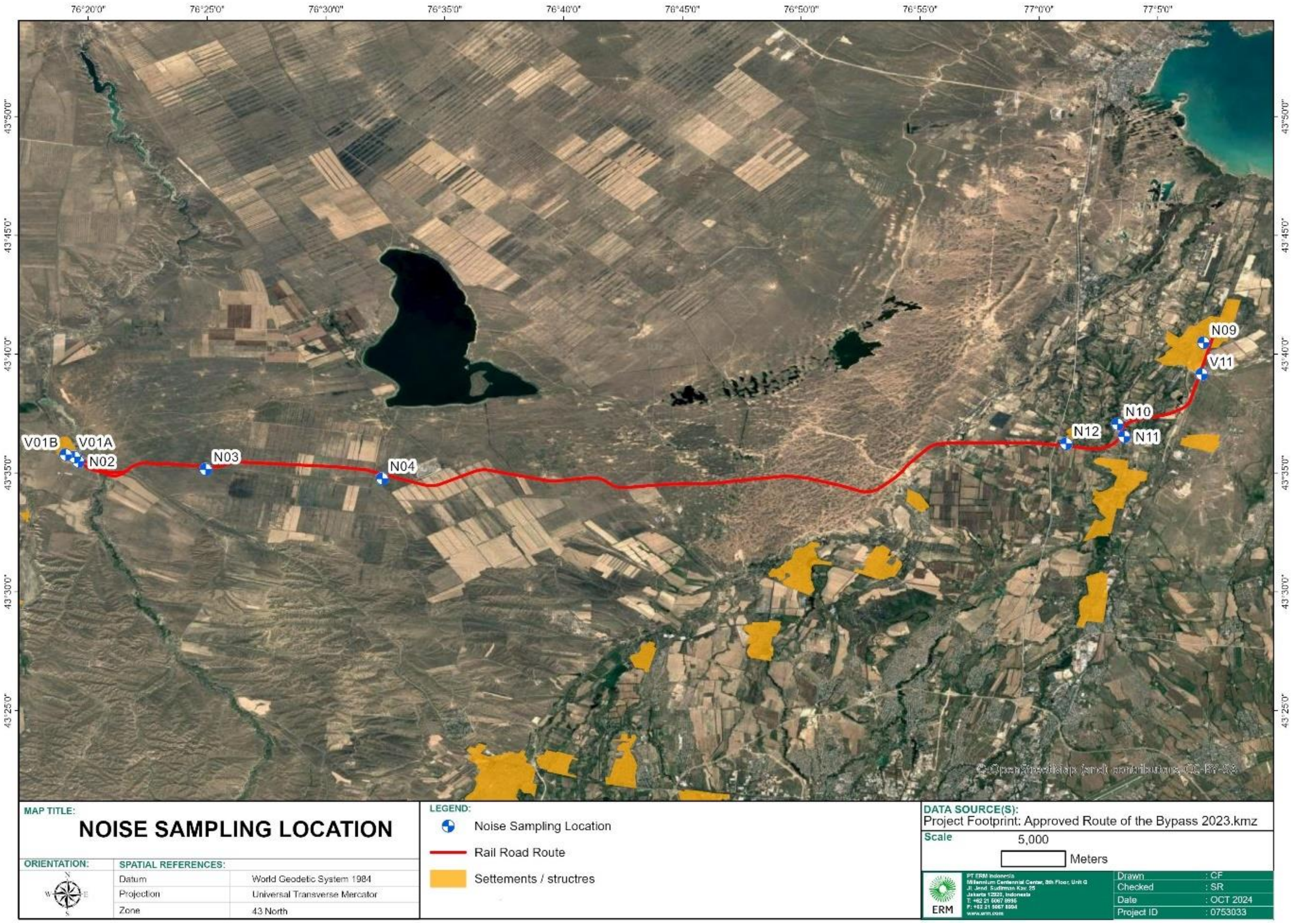
Short-term noise measurements were taken at ten (10) locations for a duration of 5 minutes at each location from 29 to 31 October 2024 in the daytime period (07:00-22:00) to get a generic profile of noise levels across the project AoI, especially at Kazybek Bek and Zhetygen as there are existing residential settlements.

The measurement locations were selected to represent a sample of receptors from various types of establishments, guided by observations made during the site visit. It is important to note that aerial imagery indicates the presence of residential receptors within 45m of the rail centreline. In light of this, we have accounted for the minimum distance from the rail centreline necessary to comply with the established limits.

The measured $L_{Aeq(5\text{-min}),\ day}$ and $L_{MAX(5\text{-min}),\ day}$ are summarised in the result summary table.

In addition, 1-hour baseline noise measurements were conducted at three (3) locations from 4 November to 7 November 2024 across the Project AoI to measure ambient noise levels at residential settlements. The noise sampling was conducted by ERM for one (1) hour during daytime and one (1) hour during nighttime (22:00-07:00) period. The three (3) locations were selected due to the close proximity of the Kazybek Bek, Zhana Arna and Zhetygen Stations. Kazybek Bek and Zhetygen Stations are considered representative of the worst-affected residential receptors. The coordinates of the locations are shown in **Figure 6-4** and **Table 6-31**. The known settlements are indicated in yellow in the figure.

FIGURE 6-4: BASELINE NOISE MONITORING LOCATIONS



6.3.4.3 BASELINE AMBIENT NOISE CONDITIONS

The $L_{Aeq(5\text{-}min)}$ and $L_{max(5\text{-}min)}$ for daytime from the 5-minute noise measurements are summarised in **Table 6-31.** The $L_{Aeq(1\text{-}hr)}$ and $L_{max(1\text{-}hr)}$ for daytime and nighttime from the one-hour noise measurements were compared with national standards and WBG EHS General Guidelines below in **Table 6-32**.

Site observations during the short-term noise measurements revealed that the primary noise sources at the selected baseline measurement locations were mainly from the existing railway and road traffic. In settlement areas, additional noise sources included farming activities and livestock sounds.

For measurement location V11 at Zhetygen, the measured nighttime noise level (62dBA) was significantly higher than the daytime noise level (54dBA). The measured noise data were plotted in **Figure 6-5** and taken for further analysis. Within the daytime measurement period, the fluctuations occurred more often at a lower magnitude (~50-60dBA). However, in the nighttime measurement, the fluctuation occurred less frequently but at a higher magnitude (~70dBA). Even though there are fewer trains at night, freight trains may operate more frequently during these hours with longer passby times when compared to passenger trains, contributing to higher noise levels.

FIGURE 6-5: BASELINE NOISE MEASUREMENT (LEQ-1HOUR) RESULTS FOR V11

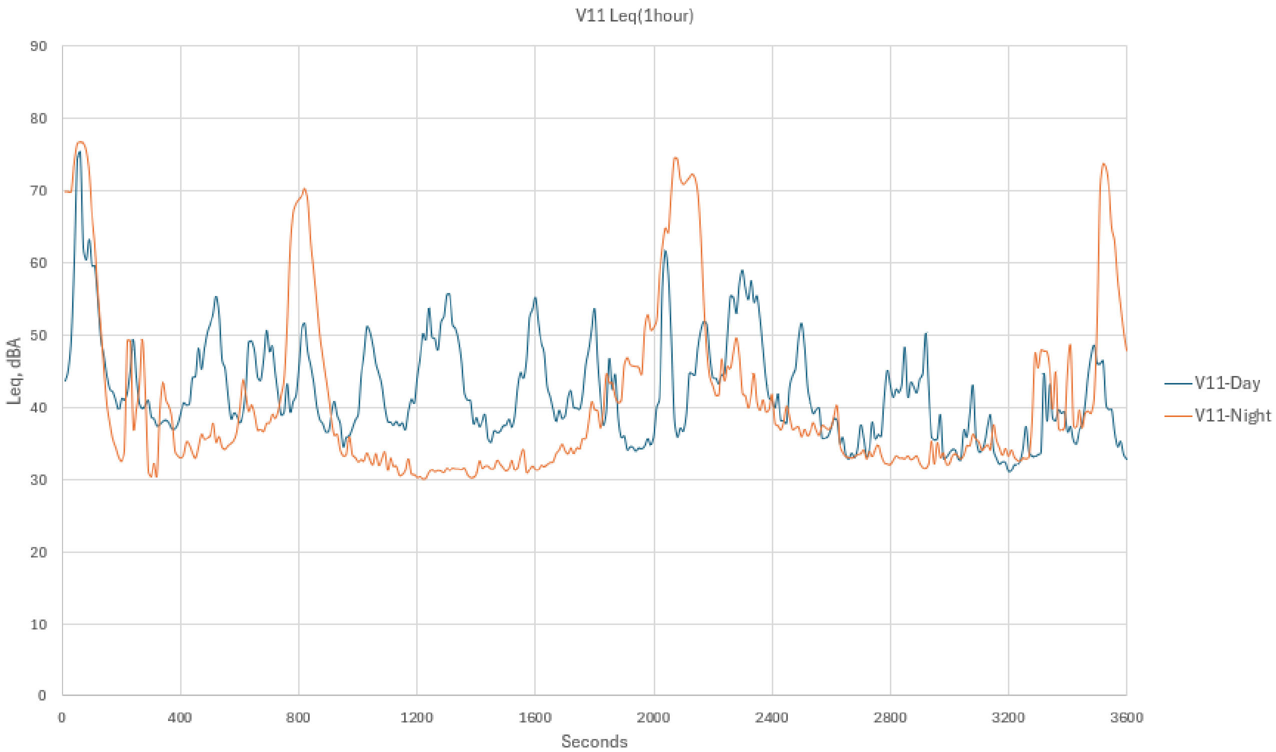


TABLE 6-31: BASELINE NOISE MONITORING LOCATIONS AND SUMMARY (5-MIN)

Location ID.	Location name	Coordinates		Sample Date and Time	$L_{Aeq(5min), day}$, dBA	$L_{max(5min), day}$, dBA	Note
N02	Christian Cemetery	43.591401	76.326387	30 October 2024 12:30 – 12:35	50	56	Railway and traffic noise
N03	Settlement / Industrial	43.585874	76.415800	30 October 2024 13:00 – 13:05	49	60	Farming, livestock (cattle) noise
N04	Settlement / Industrial	43.579364	76.539561	30 October 2024 13:47 – 13:52	38	50	Noise from racing school and farming
N09	Kindergarten (Zhetygen)	43.674805	77.115431	31 October 2024 13:02 – 13:07	45	53	Existing Railway, traffic noise, residential noise
N10	House (Zhetygen)	43.617581	77.055242	31 October 2024 15:33 – 15:38	42	53	Existing Railway, traffic noise, residential noise
N11	House (Zhetygen)	43.60886	77.05982	31 October 2024 15:52 – 15:57	42	48	Traffic noise
N12	Settlement	43.603934	77.019061	31 October 2024 16:43 – 16:48	67	78	Farming, livestock (cattle) noise
V01A	Kazybek Bek (Zhambyl)	43.594463	76.323738	29 October 2024 11:45 – 11:50	47	56	Traffic noise
V01B	Kazybek Bek (Zhambyl)	43.596102	76.317582	29 October 2024 12:02 – 12:07	55	59	Existing Railway, traffic noise
V11	Zhetygen (Iliy)	43.652585	77.114298	31 October 2024 13:35 – 13:40	60	63	Existing Railway, traffic noise

TABLE 6-32: BASELINE NOISE MONITORING LOCATIONS AND SUMMARY (1-HOUR)

Location ID.	Location name	Coordinates		Sample Date and Time	$L_{Aeq(1-hr), day}$, dBA	$L_{MAX(1-hr), day}$, dBA	$L_{Aeq(1-hr), night}$, dBA	$L_{MAX(1-hr), night}$, dBA
					Daytime (07:00-22:00)		Nighttime (22:00-07:00)	
				National Standards	55	70	45	60
				WBG General EHS Guidelines[85]	55	-	45	-
N12	Settlement	43.603934	77.019061	4 November 2024 16:09 – 17:09 22:22 – 23:22	51	61	46	50
V01B	Kazybek Bek (Zhambyl)	43.596102	76.317582	4 November 2024 19:01 – 20:01 7 November 2024 22:00 – 23:00	54	62	54	62
V11	Zhetygen (Iliy)	43.652585	77.114298	4 November 2024 12:12 – 17:09 23:48 – 00:48	54	58	62	64

Note: Values in red indicates exceedance of national standards and IFC EHS Guidelines limits.

Based on the measured $L_{Aeq(1-hr)}$ noise levels, the noise levels at V11 exceeded the nighttime noise limits under the national standard and WBG General EHS Noise Limits. The measured maximum noise levels at V01B and V11 both exceeded the nighttime $L_{MAX(1-hr)}$ under the national standard as WBG General EHS guidelines did not specify $L_{MAX(1-hr)}$ limit.

At the location of V11, based on site observation, the noise contribution was mainly from existing trainline, overhead power line and heavy construction vehicles. The higher nighttime noise levels appear to be a feature of the traffic noise and existing railway noise at this location where heavier road traffic appears to be present during the night period.

The measured baseline levels above can be used to establish the existing noise exposure, thus assessing noise impacts from:

(i) Noise impacts from operational railway according to USFTA method and compare with the criteria laid out in **Table 6-27**.

(ii) Noise impacts from operational train stations and compare with national standards and WBG General EHS noise limits stipulated above as the noise generated by train station operations comes from continuously running equipment.

[85] For Residential; institutional; educational receptors.

6.3.5 ASSESSMENT METHODOLOGY

As discussed in **Section 6.3.2.1,** the noise and vibration assessment methodology are guided by USFTA Guideline, a widely used guidelines for railway / transit project. The assessment encompasses both construction and operational impacts, ensuring a comprehensive evaluation of potential disturbances and compliance with relevant standards.

Noise impacts from construction, operational railway and train stations are assessed quantitatively. The potential noise levels are estimated based on USFTA methodology and evaluated with the limits stipulated in **Table 6-24** for construction noise, **Table 6-27** for operational railway noise and **Table 6-25** for train station operation noise.

Ground-borne vibration during construction may result from various site activities such as excavation, drilling, and heavy equipment operations. The quantitative assessment considers the vibration levels generated by each type of equipment to evaluate their potential impact on nearby receptors with the limits stipulated in **Table 6-28.**

For the operational phase, train-induced vibration is evaluated using generalised ground surface vibration curves, which provide a baseline for estimating vibration propagation. These estimates are then adjusted based on project-specific design parameters, including track structure, train type, speed, and soil conditions. This methodology ensures a comprehensive, site-specific assessment of vibration impact and are evaluated with the limits stipulated in **Table 6-29** for human responses and **Table 6-30** for building damages.

6.3.5.1 NOISE SENSITIVE RECEPTORS (NSR)

A Noise Sensitive Receptor (NSR) refers to any location or entity that could be adversely affected by noise due to its use or function. NSRs typically include areas or structures where people live, work, study, or engage in activities requiring a relatively quiet environment. They are an essential consideration in noise assessment reports to evaluate potential noise impacts from activities such as construction, transportation, or industrial operations.

Table 6-33 lists the locations of selected NSRs that are included in the noise assessment. Refer to Air Quality Section for the map of sensitive receptors (**Figure 6-3**).

TABLE 6-33: LIST OF NOISE SENSITIVE RECEPTORS (NSRS)

No.	Receptor name	Land Use Category under USFTA	Approximate distance and orientation from alignment	
NSR1	Kazybek Bek village	2- Residential	20m	North
NSR2	Residential housing for employees at Kazybek Bek Station	2- Residential	15m	North
NSR3	Srednyaya Shkola Stantsii, Kazybek Bek	2- Residential	240m	North
NSR4	Sadik Pre-school, Kazybek Bek	3 - School	210m	North
NSR5	Unnamed cemetery, near Kazybek Bek	3 - School	200m	North

No.	Receptor name	Land Use Category under USFTA	Approximate distance and orientation from alignment	
NSR6	Unnamed Christian cemetery, near Kazybek Bek	3 - Cemetery	120m	South
NSR7	Farmland and residential, near Kazybek Bek (Coordinates: 43°35'8.00"N, 76°21'53.00"E)	3 - Cemetery	185m	Southeast
NSR8	Farmland and residential, near Kazybek Bek (43°35'10.80"N, 76°24'59.20"E)	2 - Residential	35m	South
NSR9	Farmland and residential, near Sorbulak Station (43°34'48.24"N, 76°39'10.85"E)	2 - Residential	190m	North
NSR10	Residential housing for employees at Sorbulak Station	2 - Residential	Adjacent to alignment (15m)	
NSR11	Residential housing for employees at Moyinkum Station	2 - Residential	Adjacent to alignment (15m)	
NSR12	Residential housing for employees at Zhana Arna Station	2 - Residential	Adjacent to alignment (15m)	
NSR13	Alatau City [a]	2 - Residential	165m	North
NSR14	Farmland and residential, near Zhetygen Station (43°37'17.44"N, 77° 4'42.71"E)	2- Residential	80m	South
NSR15	Residential housing for employees at Zhetygen Station	2- Residential	Adjacent to alignment (15m)	
NSR16	Alatau City [b]	2- Residential	45m	West

Notes:
[a] Located at an area of the newly established Alatau city that was once Zhana Arna village. On 9 January 2024, Zhana Arna was officially integrated into the newly established city of Alatau, which was formerly known as Zhetygen.
[b] Located at an area of the newly established Alatau city that was once Zhetygen village. On 9 January 2024, Zhetygen was granted city status and renamed Alatau.
Source: The Astana Times. (2024, January). *Kazakhstan welcomes new town Alatau*. The Astana Times. Retrieved from https://astanatimes.com/2024/01/kazakhstan-welcomes-new-town-alatau/

6.3.5.2 PARAMETERS

Noise Parameters

Ambient noise levels are typically described by several parameters. The most commonly used parameter to describe noise level is L_{Aeq}, which refers to Equivalent Continuous Sound Pressure Level, is the average noise level over the measurement period. Sound measurement is refined by using an A-weighted scale, which is the range of sound frequencies most audible to the human ear. Unless otherwise noted, all dB measurements presented in this Supplementary ESIA are A-weighted (dBA) on a logarithmic scale.

The limits of L_{max} are defined in the national limits as the maximum sound level during a single noise event meanwhile WBG EHS General Guidelines do not specify the limits on L_{max}.

Vibration Parameters

Vibration levels are quantified using several key parameters, with Vibration Velocity Level (VdB) and Peak Particle Velocity (PPV) being the most commonly used .

- **VdB (Vibration Velocity Level in Decibels):** This is the standard metric for assessing vibration levels, particularly in relation to human perception and comfort. It measures the root mean square (rms) velocity of vibrations and is expressed in decibels (dB) relative to a reference level.
- **PPV (Peak Particle Velocity)**: PPV is primarily used to assess construction-related vibration impacts on structures. It represents the highest instantaneous velocity of a vibrating particle and is expressed in millimetres per second (mm/sec) or inches per second (in/sec).

Ground-borne Vibration refers to vibrations transmitted through the ground, often from construction, machinery, or transportation. These vibrations can affect structural integrity and human comfort. Ground-borne vibration related to human annoyance is related to Root Mean Square (rms) velocity levels, expressed in VdB.

Ground-borne Noise refers to the low-frequency noise caused by vibrations traveling through the ground and radiating as sound within buildings. The unit for ground-borne noise is typically measured in A-weighted decibels (dBA).

6.3.5.3 CONSTRUCTION PHASE

A) Construction Noise

This section outlines the methodology used to assess construction noise for the Project, based on the described construction activities. The noise assessment at receptors is performed by comparing the predicted sound levels at those locations to the applicable noise limits. **Table 6-34** lists the expected construction equipment types, quantities and maximum sound levels for each of the project segment.

Key Assumptions

- All construction equipment and activities are confined to designated construction areas, sites, and along the track alignment, all of which are within the Project AoI.
  - The assessment follows the USFTA Manual and BS 5228[86] for reference construction equipment noise levels.
  - The construction equipment noise used in construction noise calculation are referenced from USFTA Guideline and BS 5228 as noise specifications for the actual equipment on-site were not provided.
  - Construction activities are anticipated to occur 8 hours per day, 5 days per week in the daytime only. Construction schedules will be finalised during the detailed design phase.

[86] British Standards Institution. (2019). *BS 5228: Code of practice for noise and vibration control on construction and open sites*. Part 1: Noise. Part 2: Vibration. BSI Standards.

- The types and quantities of construction equipment anticipated for each phase or activity are estimated based on provided info.
- Details of the plant 'percentage on time' were not available at the time of the assessment so it has been assumed that each plant item / activity operates of the 50% of the time. It should be noted however that this is still considered conservative for some activities.
- Due to the phased implementation of the Project, construction noise predictions for areas without an established construction equipment schedule (e.g., Zhetygen) have not been included in this assessment.

Project Activities - Noise

Noise impacts can be caused by noise emissions from construction equipment (earthmovers, etc.), and construction vehicles carrying materials and spoil to and from the locations where work is taking place along the Project.

Noise impact from the Project construction activities will arise principally from the following activities:

- Construction of the 75km railway bypass main track and the ancillary tracks and facilities
- Construction of the five (5) stations including depots, transmission lines, maintenance and servicing facilities, workers accommodation, and other supporting infrastructure. Train stations will include new access roads, sidewalk pavements, landscaping area and other areas
- Site preparation, land clearing, burrow pits excavation, other excavation works, backfilling and earthworks
- Concrete works (foundations)
- Installation of metal structures
- Laying of the track, track ballasting, track superstructure
- Network system installation
- Vertical signalling posts and railway crossings at stations and alignment sections between stations
- Bridges, Cattle runs, railway overpasses, road overpasses
- Foundations, piling caps and piers
- Construction of culverts, drainage and water management structures
- Landscape works
- Construction of temporary ancillary facilities

Construction activities such as blasting activities for borrow areas may generate significant noise and vibrations. The noise and vibration impact from the equipment for such activities are assessed quantitatively using the methods below.

It should be noted that changes in road traffic noise during construction may arise as a result of construction activities such as the deliveries of materials. As the stationary noise sources will dominate the traffic noise, therefore the traffic noise was not assessed quantitatively.

Quantitative Assessment

Noise emissions from construction activities, as listed above, were predicted using the general assessment in accordance with USFTA Guideline. The calculations were based on preliminary construction schedules and equipment lists provided by the design team and typical sound power levels extracted from the Guideline.

According to USFTA's Chapter 7 Noise and Vibration during Construction, the construction noise impact for major transit projects at each section of the Project are predicted based on the number of equipment and the equipment typical noise emission levels ($L_{eq.equip}$). The $L_{eq.equip}$ from individual equipment is calculated using the equation below.

$$L_{eq.equip} = L_{emission} + 10\log(Adj_{Usage}) - 20\log\left(\frac{D}{50}\right) - 10G\log\left(\frac{D}{50}\right)$$

Where:

$L_{eq.equip}$ = $L_{eq(t)}$ at a receiver from the operation of a single piece of equipment over a specified time period, dBA

$L_{emission}$ = noise emission level of the particular piece of equipment at the reference distance of 50 ft, dBA

Adj_{Usage} = usage factor to account for the fraction of time that the equipment is in use over the specified time period.

D = distance from the receiver to the piece of equipment, ft

G = a constant that accounts for topography and ground effects; value of 0 for free-field conditions with maximum ground absorption.

With the calculated $L_{eq.equip}$ of each equipment, the $L_{eq.equip}$ is adjusted with the number of equipment. All equipment's $L_{eq.equip}$ will then be summed up to get the overall construction noise level at a certain distance using the distance correction factor equation from USFTA below.

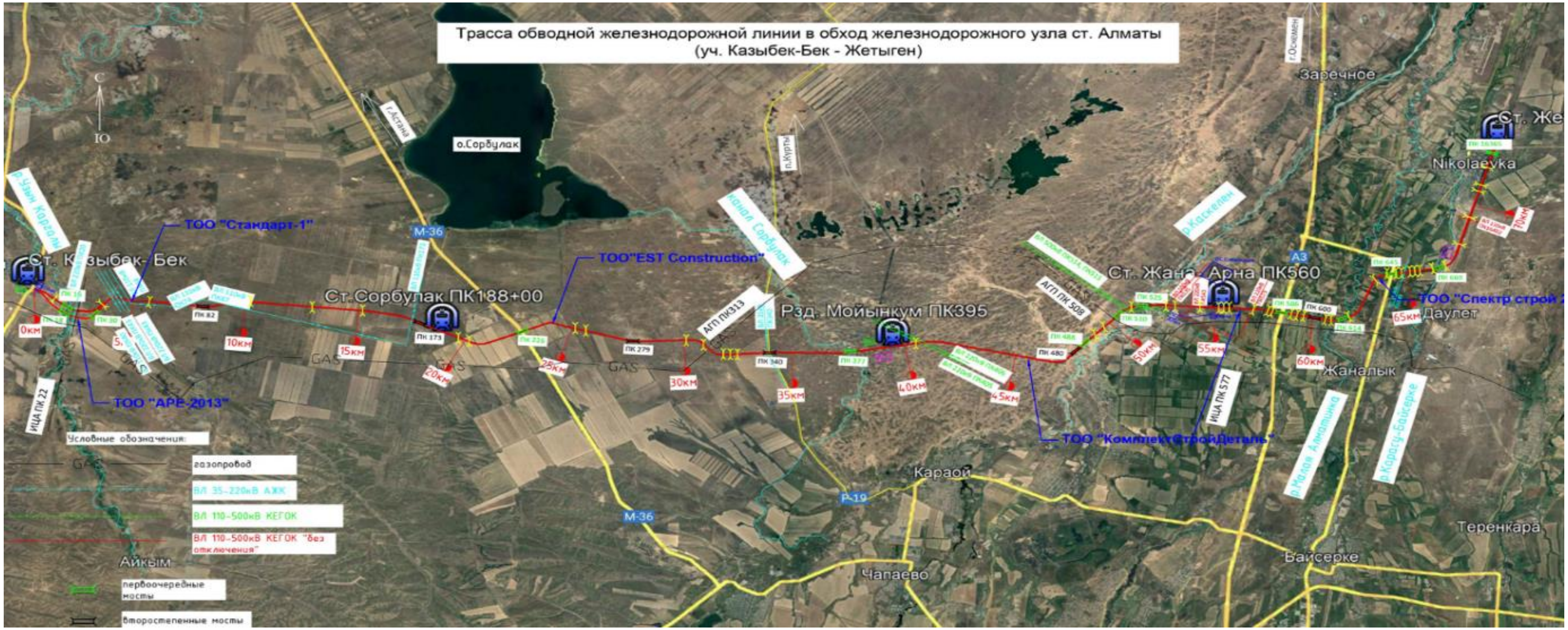
$$L_{eq.total\ at\ 50ft} = 10\log\left(\sum 10^{\frac{L_{eq.equip}}{10}}\right)$$

$$SPL_{total\ at\ NSR} = L_{eq.total\ at\ 50ft} - 25\log\left(\frac{NSR\ distance\ in\ ft}{50}\right)$$

The construction section layout is shown in **Figure 6-6**. The construction noise data was provided by segments and by Contractors:

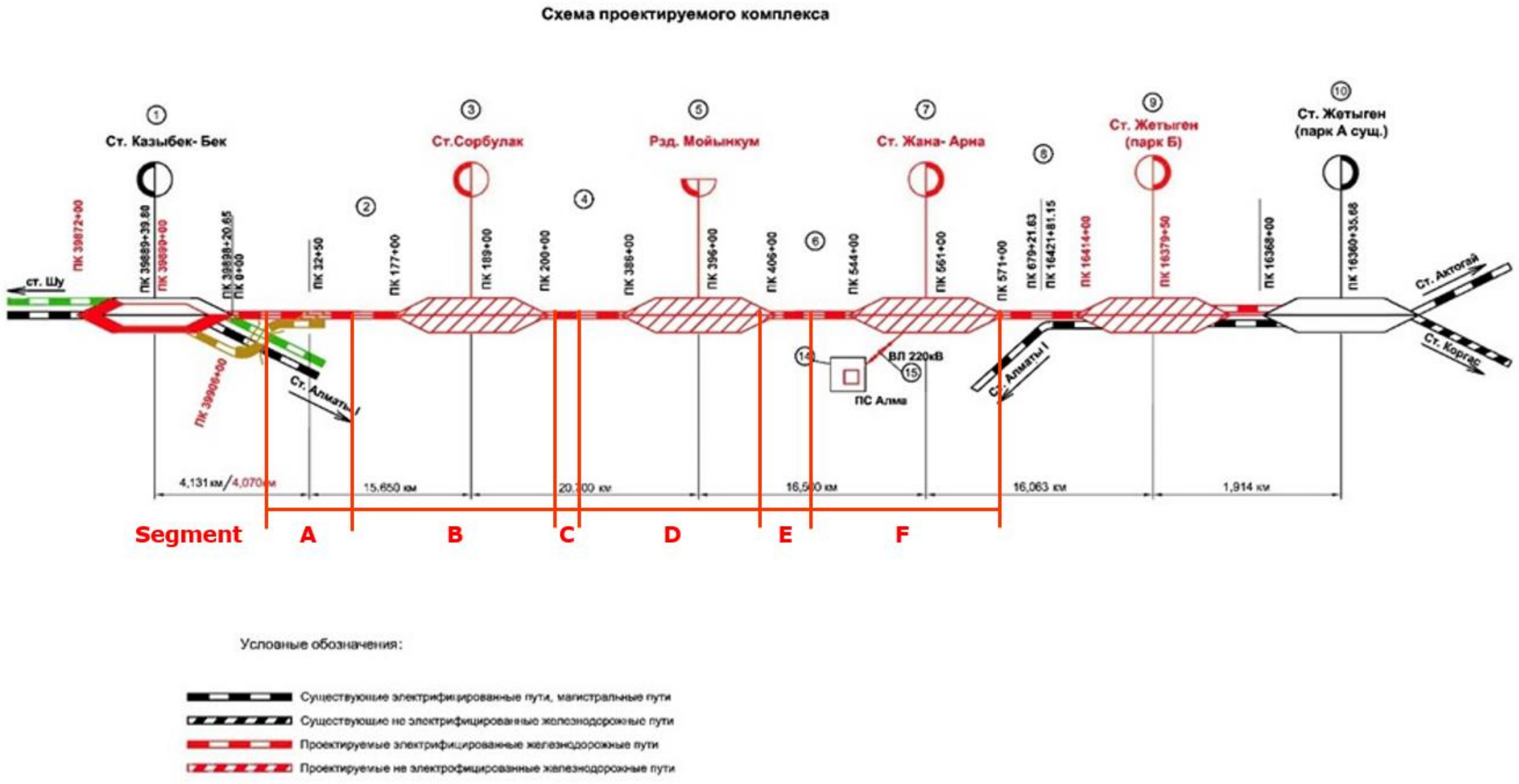
- By Segment: The construction equipment type and number of units are provided for each segment (from A to F). However, no construction data was provided for the remaining alignment at the Kazybek Bek on the west of ПК30 and extending from segment F eastward to Zhetygen.
- By Contractor: The specific locations of these works were not provided by the Developer (referred to as KTZ throughout the report). For the purpose of this assessment, it has been assumed that the equipment under different contractors will be operating along the alignment simultaneously across multiple sites. The five contractors are HMC LLP, Project NS, PSC Vostok Story, "KAZSTROYCOMPANY"T" LLP and Adal Zhol BN.

FIGURE 6-6: CONSTRUCTION SECTION LAYOUT



Note: Contractor III - PSC Vostok Stroy for construction noise impact quantification) is responsible for the construction of both Kazybek Bek Station and Zhetygen Station, in which residential receptors are located within 50m from site activities, including employee accommodation at the stations. The other Contractors mainly work on the railway segment between Kazybek Bek Station and Zhetygen Station.

FIGURE 6-7: CONSTRUCTION SEGMENT



Note: Residential settlements located at Kazybek Bek and Zhetygen have residential receptors within 50m from railway centre. There are no residential receptors between Segments A to F are between the two areas. The noise limits of commercial/industrial areas shall be adopted for these areas (100dBA for daytime and nightime).

TABLE 6-34: CONSTRUCTION EQUIPMENT NOISE EMISSION LEVELS

Equipment	Reference [b]	% on time	SPL at 15m, dB(A)
Excavator	BS 5228 Table D.2-5	50%	92 [a]
Truck crane, Mobile	USFTA Table 7-1	50%	83
Motor Grader	BS 5228 Table D.9-10	50%	85
Loader	BS 5228 Table D.3-10	50%	80
Bulldozer	USFTA Table 7-1	50%	85
Dump Trucks	USFTA Table 7-1	50%	84
Fuel Tanker	BS 5228 Table C.4-15	50%	72 [a]
Water Carrier	BS 5228 Table D.11-52	50%	85 [a]
Thrall	BS 5228 Table C.1-7	50%	89 [a]
Bus	BS 5228 Table C.11-18	50%	84
Pile Driving	USFTA Table 7-1	50%	101
Mixer	USFTA Table 7-1	50%	85
Drilling	USFTA Table 7-1	50%	95
Vehicles	USFTA Table 7-1	50%	84

Note:
[a] SPL referenced from BS 5228 and adjusted distance to 15m.
[b] USFTA (2018) - Table 7-1 Construction Equipment Noise Emission Levels

The noise levels from construction activities including earthworks, linear works and linear structure works are combined to predict the worst-case construction scenario. Calculations of the combined level $L_{Aeq(1hr)}$ were then carried out to determine how far from the activities a receptor would need to be for the construction noise to result in a no impact, moderate and severe impact of predicted impacts for each NSRs.

Due to the complex construction arrangement stated above, the construction noise levels are predicted using USFTA method at 50m from construction activities. Additional evaluation is conducted based on the magnitude of noise impact.

Impact Rating

The significance of noise impacts is typically evaluated by comparing measured noise levels with regulatory limits set by organisations such as the WHO, IFC, and USEPA. The severity of the impact increases as the exceedance of these limits grows. A general impact rating system for noise exceedance is presented in **Table 6-35**, which provides a framework for assessing the extent of potential noise impact.

TABLE 6-35: NOISE IMPACT RATING – CONSTRUCTION NOISE

Exceedance from limits, dB	Impact Level	Significance Description
>10	Major	Significant increase; likely to cause serious disturbance, requiring mitigation.
≤10 but ≥5	Moderate	Noticeable increase; may cause annoyance and require mitigation in sensitive areas.
<5 but ≥3	Minor	Slight increase; some level of disturbance but generally acceptable.
<3	Negligible	Minimal or no noticeable impact.

B) Construction Vibration

Key Assumptions

- Vibrations attenuate with distance based on an empirical formula shown below. It is assumed to have averaged soil type (mixed soil with moderate attenuation and common in urban environment).
- It is assumed that there is no obstruction between the construction equipment and receptors.
- The construction equipment PPV used in vibration calculation are referenced from USFTA as shown in **Table 6-36.** Vibration specifications for the actual equipment on-site were not provided.

Project Activities - Vibration

The vibration-inducing construction equipment from earthworks are taken for construction vibration calculation. The construction equipment that can contribute to high vibration levels are summarised below in **Table 6-36.**

TABLE 6-36: CONSTRUCTION EQUIPMENT VIBRATION LEVELS FROM EARTHWORKS

Equipment	PPV at 25 ft, in/sec	Approximate L_v at 25 ft, VdB
Excavator	1.518	112
Loader	0.076	86
Bulldozer	0.089	87
Thrall	0.035	79
Pile Driver	1.518	112
Drilling	0.089	87
Reference: USFTA (2018) - Table 7-4 Vibration Source Levels for Construction Equipment		

Quantitative Assessment

To assess the building damage for each individual equipment with propagation adjustment.

$$PPV_{equip} = PPV_{ref} \times \left(\frac{25}{D}\right)^{1.5}$$

Where

PPV_{equip} = the peak particle velocity of the equipment adjusted for distance, in/sec

PPV_{ref} = the source reference vibration level at 25ft, in/sec

D = distance from the equipment to the receiver, ft

Impact Rating

Based on the USFTA Guideline, construction vibration impacts shall be categorised as:

- **No Impact** / **Negligible** - Vibration levels are below thresholds of concern. No mitigation or further assessment is needed.
- **Have Impact** - Vibration levels exceed thresholds for human annoyance or structural damage as indicated in **Section 6.3.2.2**. May require mitigation, depending on site-specific factors and sensitivity of receptors.

6.3.5.4 OPERATIONAL PHASE

A) Operational Noise from Freight Trains

During the operational phase, noise emissions will primarily originate from railway activities, including train movements along the tracks and noise generated at station areas. The assessment of operational noise levels follows the USFTA Fixed-Guideway General Noise Assessment methodology, a standardised approach for evaluating noise impacts from rail transit systems. This method is considered an appropriate approach to operation noise impact assessment, as they incorporate stringent thresholds to minimise potential disruptions to communities. The guideline is designed to account for the sensitivity of residential areas, with noise limits that ensure even modest increases in noise levels are carefully evaluated to prevent significant community annoyance. By prioritising a cautious and proactive stance, the USFTA Guideline provide a robust framework for assessing environmental impacts and ensuring that transportation projects meet stringent criteria to protect public health and quality of life. This conservative approach helps safeguard communities from the long-term effects of noise pollution, ensuring that projects are developed in harmony with the surrounding environment.

To ensure an accurate representation of noise conditions, noise levels are computed using USFTA-approved calculation methods, incorporating various factors such as train track design, distance to NSRs, baseline ambient noise conditions and mitigations.

In the USFTA methodology, Option A criteria is adopted as Option B requires selecting the appropriate assessment method based on Table 4-2 in the guidelines. Since the dominant noise source for this Project is categorised as “Transit, at All Times,” in which both Option A and Option B ultimately follow the same methodology outlined in Step 2. Additionally, the existing railway line is already considered in the criteria, as the current noise exposure is used to determine the project’s exposure limits. Choosing Option A ensures a fair assessment of impacts without overestimating the influence of existing background noise.

The assumptions and input parameters used in the noise modelling process are detailed in this section, providing a comprehensive basis for evaluating potential noise impacts and determining the need for mitigation measures.

Key Assumptions and Calculation Input

The specific type of electric locomotive planned for use during the operational phase is outlined in **Table 6-37**. The technical specifications, including power output, noise emissions, and vibration characteristics, are based on the 2023 Operational Design Report, prepared by Poligram LLP (Document Reference: 754189/2022/1-OPZ).

Additionally, key operational parameters—such as train frequency, speed profiles, and station dwell times—were verified during an on-site clarification visit conducted on 17 January 2025. This site visit provided valuable insights into real-world conditions and ensured alignment between theoretical design assumptions and practical implementation.

TABLE 6-37: TRAINS OPERATION INPUT

	Freight Train
Type	KZ-8A
Maximum speed	120 km/hr
Operating average speed	60 km/hr [a]
Operating speed at 1.5km from station	40 km/hr
Operating speed at 100m approaching station	20 km/hr
Trains per day	• 27 freight trains per day for each direction. • Total 54 trains in both directions per day.
Rail cars per train	• Average 45-50 cargo rail cars in operational and maximum 50-60 in total. • Operational noise calculated based on 60 rail cars.
Operation time	• 12:00am to 12:00am (24 hours per day) • At the time of noise assessment, the train schedule was not yet available. It is assumed to have the trains distribute evenly for the 24 hours, resulting average hourly volume of 2.25 train/hour.
Embedded controls	• R-65 rail tracks with SKL 30 rail tension clamps, adjoined and with gravel and sand ballasts. (-3dB) • Speed change (see above), reducing train speed can result in noise level reduction.

Note:
[a] Trains at rural area are restricted to travel to a maximum speed of 60km/h.
[b] Calculation for freight train operation is based on maximum rail cars of 60.
Reference: Poligram (2023)

The freight rail includes noise components including the locomotive and rail cars**.** The project noise sources, and reference levels at (SEL) are referenced from USFTA. The SEL_{ref} will be used or operation quantitative assessment. **Table 6-38** showed the SEL reference levels, calculated noise levels of the freight train components and the combined noise level at 50ft (or 15m).

TABLE 6-38: NOISE COMPONENTS OF FREIGHT TRAIN DURING OPERATION PHASE

Noise Components	Reference SEL [a], dBA	$L_{Aeq(1hr)}$ at 50ft (15m), dBA		
		Average operating speed (60km/hr)	Operating speed at 1.5km from stations (40km/hr)	Operating speed at 100m from stations (20km/hr)
Locomotive	92	59	57	54
Rail Vehicles	82	67	64	58
Combined Locomotive and transit $L_{Aeq(1hr)}$ at 50ft		**68**	**65**	**59**

Note:
[a] SEL reference speed is 50mph.
Reference: USFTA (2018) – Table 4-9 Reference SEL's at 50ft from track and at 50mph, with one vehicle

Quantitative Assessment

The noise exposure resulting from rail operations at a reference distance of 50ft ($L_{eq(1hr)}$) has been computed using the formulas outlined in **Table 6-39**. These equations assess the various sources of noise generated during operation, including the locomotive and rail vehicles. Below is a breakdown of the relevant equations.

TABLE 6-39: COMPUTATION OF NOISE EXPOSURE AT 50FT FOR FIXED-GUIDEWAY GENERAL NOISE ASSESSMENT

Noise Component	Equation
Locomotives	$L_{eq,Loco(1hr)} = SEL_{ref} + 10\log(N_{Loco}) + K\ \log\left(\frac{S}{50}\right) + 10\log(V) - 35.6$
Rail Vehicles	$L_{eq,Rcars(1hr)} = SEL_{ref} + 10\log(N_{cars}) + 20\log\left(\frac{S}{50}\right) + 10\log(V) - 35.6 + Adj_{track}$
Combined Locomotive and transit	$L_{eq,combo(1hr)} = 10\log(10^{\frac{L_{eq,Loco(1hr)}}{10}} + 10^{\frac{L_{eq,Rcars(1hr)}}{10}})$

Where:
N_{Loco} = average number of locomotives per train
K = constant (-10 for diesel)
S = train speed, mph
V = average hourly volume of train traffic, trains per hour
Adj_{track} = constant
+5 for jointed track
-3 with gravel and sand ballasts
(-5 if a noise barrier blocks the line of sight)

The project noise exposure for locations beyond the reference distance at the NSR was estimated with the distance correction equation below for fixed-guideway.

$$C_{distance} = -15\log\left(\frac{D}{50}\right)$$

Where: D = distance, ft

The operation noise levels of freight trains are calculated to estimate the overall noise levels at three (3) speeds:

(1) **Open Track** – This scenario accounts for noise levels in areas where there are no train stations, train is operating at normal speed of **60 km/hr**.
(2) **1.5km from Train Stations** – This scenario considers areas within 1.5km radius from the train stations, train is operating at reduced speed of **40 km/hr**.
(3) **100m from Train Stations** – This scenario considers areas within 100m radius from the train stations, train is operating at minimal speed of **20 km/hr**.

Impact Rating

The impact rating system used for assessing operational noise is outlined in **Table 6-27**. The impact levels are determined by comparing the estimated overall noise levels against the existing baseline conditions.

B) Operational Noise from Train Station

The operation noise levels from train station are mainly from mechanical and electrical equipment such as centrifugal fans, pumping stations, transformers, cargo equipment and compressors etc. The mechanical noise from building equipment may impose negative impacts to the residents nearby. As the operational noise from train stations was evaluated in the National EIA, the quantitative results are re-assessed in this Supplementary ESIA.

Quantitative Assessment

For this assessment, only stations with residential areas within 200m were considered, as noise impact beyond this distance is generally negligible[87]. Since residential areas are located within 200m of the railway centreline at Kazybek Bek and Zhetygen stations, the highest predicted noise levels in these areas were calculated using the acoustic software ПК ЭРА v3.0 (PC ERA v3.0). This software employs a noise prediction method based on the internationally recognised ISO 9613-2 standard for outdoor sound propagation.

Impact Rating

As the noise sources are stationary and continuous, the predicted noise levels at the stations are evaluated against national noise limits / IFC guidelines detailed in **Table 6-25.**

C) Operational Vibration

Train-induced vibrations largely depend on factors such as the smoothness of the wheels and rails and the resonance frequencies of the train's suspension and the track's support systems. These mechanical systems exhibit resonant behaviour, amplifying vibrations at specific frequencies known as their natural frequencies.

Key Assumptions & Calculation Input

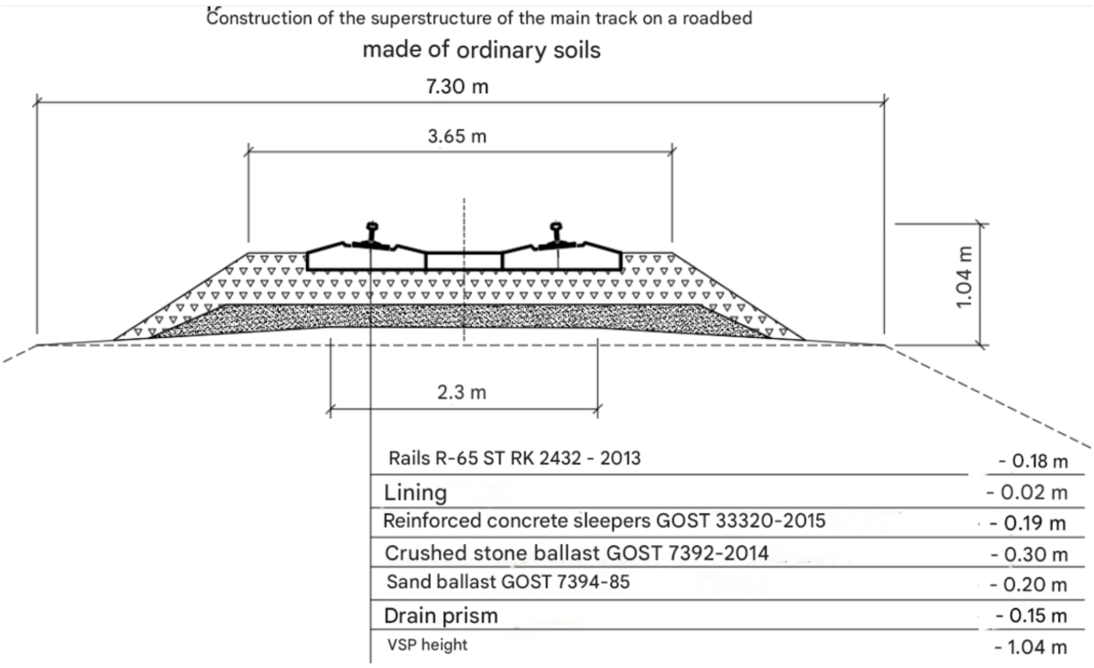
The train track design is summarised in this section.

- The main track of the bypass railway line with roadbed made of ordinary soils.

[87] Murphy, E., & King, E. A. (2014). *Environmental noise pollution: Noise mapping, public health, and policy.* Elsevier.

- Reinforced concrete beams and sleepers with elastic rail fasteners.
- Crushed stone ballast on sand bed.
- Installation of the bottom layer of ballast from sand (gravel-sand mixture), 20 cm thick with delivery to the site by dump trucks and levelling by a motor grader.
- The superstructures are equipped with anti-seismic devices for use in areas with an estimated seismicity of nine (9) points.
- For metal bridges, the structure of the bridge deck on the bridge is adopted on ballast or wooden crossbars. Crushed stone ballast made of natural stone.

FIGURE 6-8: SUPERSTRUCTURE OF MAIN TRACK



Quantitative Assessment

The general ground surface vibration level base curve for locomotive-powered freight trains is estimated using the following base curve equation from USFTA :

$$L_V = 92.28 + 14.81\log(D) - 14.17\log(D)^2 + 1.65\log(D)^3$$

Where

L_V = velocity level, VdB

D = distance, ft

This equation provides the baseline ground vibration level as a function of distance from the railway track. After obtaining the base vibration level, source adjustments are made according to USFTA based on the train design.

The adjustment factors are listed below. The noise adjustments for the following train design are taken from Table 6-11 in USFTA guidelines:

- Speed adjustment: 60km/hr (-1.9dB), 40km/hr (-4.4dB) and 20km/hr (-8.0dB)
- Vehicle parameters: Resilient wheels - +0dB
- Track Conditions: Uneven road surfaces - +5dB
- Track Treatments: Elastic rail fasteners - -5dB

For speed adjustment, the following equation is used:

$$Adj_{speed} = 20\log\left(\frac{speed}{speed_{ref}}\right)$$

Where Adj_{speed} = Adjustment for speed, dB

For the vehicle parameters, track conditions and track treatment, the adjustment can be applied to the adjusted L_V.

The adjusted vibration levels can be evaluated against the ground-borne vibration thresholds stated in **Table 6-30.** This comparison determines whether the vibration levels exceed the thresholds for human annoyance or structural damage at assessed locations.

Impact Rating

The USFTA ranks the impact of operational vibration based on a three-tier classification system:

1. **No Impact (Negligible)** - Vibration levels are below the established thresholds. No mitigation or further assessment is needed.
2. **Moderate Impact -** Vibration levels exceed the threshold but are not significantly above it. Potential for noticeable vibration, but effects may not be severe. May require mitigation, depending on site-specific factors and sensitivity of receptors.
3. **Severe (Major) Impact -** Vibration levels far exceed the criteria. High likelihood of human annoyance or damage to structures. Mitigation is strongly recommended.

6.3.6 IMPACT ASSESSMENT

Within the Project area, there are settlements within the Project AoI particularly at Kazybek Bek on the west end and Zhetygen in the east. However, for the most part of the alignment between these stations, there are no major settlements (see **Figure 6-4**). Generally, the further the receptor is from the construction activities or the train operation, then the less adversely affected they would be as they would be exposed to less noise given the distance and the possible screening provided by the intervening buildings and natural topography. Therefore, the worst-case receptors are those closest to the Project footprint.

Activities during the construction phase inherently produce high levels of noise, and therefore some noise impacts from these activities cannot be avoided, although the impacts are often short-term and only last for the duration of the construction activity.

Operation of the Project will result in the creation of a new permanent railway noise source, so the effect is long-term. There will also be changes to the speed and the number of train cars and trains per day. These changes will also affect the level of noise emitted.

Vibration impacts are expected during construction and operation stages. Construction vibration impacts are expected to be short-term. Where there is sufficient soft ground between the vibration inducing activities and receptors, it is unlikely for ground-borne vibration due to standard construction methods to exceed the thresholds at which vibration effects could become significant, which is expected to be the scenario for most construction activities associated with this Project. Some areas may experience higher levels of vibration during major construction activities for large structures, such as bridges, that may warrant a more detailed vibration assessment as the construction strategy is developed further.

The operational vibration impact from moving trains primarily arises from the friction between the rail tracks and wheels. However, similar to construction-related vibrations, significant exceedances are not expected due to the well-engineered design of the system and the distance between the rail lines and nearby receptors.

6.3.6.1 CONSTRUCTION PHASE

(A) Noise from Construction Activities

Embedded Controls

The National EIA outlined the following measures to minimise noise impacts from construction activities. During the operation of machinery and equipment, as well as during the organisation of workspaces for personnel during the construction of the planned facilities, all necessary steps will be taken to reduce noise to levels within permissible limits.

- Siting noisy activities and plant as far as possible from sensitive receptors.
- Limiting noisy activities to specific hours (e.g., daytime) to reduce disturbances to nearby residents and communities.
- Selecting quieter plant and vehicles, e.g., electric-powered equipment instead of combustion engines, where possible.
- Switching off plant and vehicle engines when not in use.
- Establishing a buffer zone between construction activities and sensitive receptors.
- Mandatory compliance of construction equipment, mechanisms, vehicles, processes, and operations with national laws and regulations.
- Effective communication with the occupants of the nearby sensitive receptors that could be at risk of being exposed to higher (although temporary) noise emissions during significant stages of work.
- Ensuring that site personnel are aware of the embedded measures listed.
- During road construction, areas with sound levels exceeding 80dBA must be clearly marked with safety signs. Additionally, individuals working in these zones must be provided with appropriate personal protective equipment.
- Production areas with engineering equipment with a high noise level are fenced off by partitions.
- Configuring the construction traffic control system to minimise the need for mobile plant to reverse. Where reversing cannot be avoided, use alternatives to tonal reversing alarms, such as visual and/or broadband noise-emitting models.
- Lowering items in a controlled manner rather than dropping them from heights.
- Regularly maintaining equipment, plant, and enclosures.

- Speed limit for site vehicles/trucks within the construction area.

Impact Magnitude

The noise levels from construction activities including earthworks, linear works and linear structure works are combined to predict the worst-case construction scenario. Calculations of the combined level $L_{Aeq(1hr)}$ were then carried out to determine how far from the activities a receptor would need to be for the construction noise to result in a no impact, moderate and severe (major) impact of predicted impacts.

Construction noise levels at all different segments and from different contractors are predicted using USFTA method at 50m from site activities (as a reference level) and summarised in **Table 6-40.**

As indicated under **Figure 6-7,** there are no residential receptors between Segments A to F between Kazybek Bek and Zhetygen. The daytime and nighttime limit for industrial / commercial areas is 100dBA as per **Table 6-24.** From the construction noise results below, as there are no residential receptors present within these segments, there is no exceedance at 50m or beyond, therefore the construction noise along segments A to F is within the limits.

For the residential settlements at Kazybek Bek and Zhetygen, as day and nightworks are anticipated during construction period, the night-time noise levels of residential receptors (80dBA) shall be assessed at these areas. As mentioned under **Figure 6-6**, Contractor III is the responsible for these stations. As the construction noise from Contractor III is estimated at 87dBA, it does not exceed the daytime limit of 90dBA, it showed a 7dB exceedance at nighttime at a distance of 50m from the site activities. Noise levels at 100m and 150m from site activities is calculated and summarised inContractor III is the responsible for these stations. As the construction noise from Contractor III is estimated at 87dBA, it does not exceed the daytime limit of 90dBA, it showed a 7dB exceedance at nighttime at a distance of 50m from the site activities. **Table 6-41** below to check for compliance with residential limits. There is no exceedance shown for distance beyond 100m from site activities.

The following construction noise predictions are based on the worst-case scenario without additional mitigation measures, actual construction noise levels are often lower than the predictions.

TABLE 6-40: CALCULATED CONSTRUCTION ACTIVITY NOISE LEVELS AT DIFFERENT SEGMENTS – 50M FROM SITE ACTIVTIES

Segment	**Description**	**Activity Noise Levels at 50m, dBA**			**Combined Activity Noise Levels at 50m, dBA**	**Daytime / Nighttime Limits**	**Exceedance**	
		Earthworks	Linear Works	Linear Structures				
A	PK30-PK177 TOO "Standard-1"	87	86	86	91	100	No exceedance	
B	PK177-PK300 TOO "PTSM"	83	88	88	92			
C	PK300-PK370 TOO "VG EXECUTIVE"	83	81	0	85			
D	PK370-PK470 TOO "ECT Construction"	87	79	0	87			
E	PK470-PK544 TOO "Komplekt Stroy Detal"	90	93	93	97			
F	PK590-PK680 TOO "Spectr stroy 2050"	83	87	87	90			
ID	**Contractor**					**Daytime / Nighttime Limits**	**Exceedance (daytime)**	**Exceedance (nighttime)**
I	TOO HMC	81	88	88	91	100	No exceedance	
II	Project NS	80	82	82	86	100	No exceedance	
III	PSC Vostok Stroy	82	82	82	87	90/80	No exceedance	7
IV	TOO "KAZSTROYCOMPANY"T"	0	86	86	89	100	No exceedance	
V	Adal Zhol BN	0	75	75	78	100	No exceedance	

TABLE 6-41: CALCULATED CONSTRUCTION ACTIVITY NOISE LEVELS FROM CONTRACTOR III AT KAZYBEK BEK AND ZHETYGEN STATIONS

ID	Contractor	Combined Activity Noise Levels at distance	Activity Noise Levels at distance, dBA			Combined Activity Noise Levels at distance, dBA	Daytime / Nighttime Limits	Exceedance
			Earthworks	Linear Works	Linear Structures			
III	PSC Vostok Stroy	50m	82	82	82	87	90/80	No exceedance during daytime, 7dB exceedance at nighttime.
		100m	75	74	74	79		No exceedance
		150m	70	70	70	75		No exceedance

Impact Significance

In summary, construction noise levels from the Kazybek Bek and Zhetygen stations will exceed nighttime limits by 7dB for residents within 50 meters, resulting in a **Moderate** impact at nighttime according to the rating method stated in **Table 6-35**.

Based on the above analysis, the project's potential impacts on noise sensitive receptors resulting from noise during construction (worst-case with combined earthworks, linear works and linear structure) will be **Major-negligible** in magnitude depending on the distance of the receptors from the site activities, local in extent, and short-term in duration, with an overall pre-mitigation significance of the following for each segment.

TABLE 6-42: PRE-MITIGATION IMPACT SIGNIFICANCE OF CONSTRUCTION NOISE OF NSRS

NSR	Description	Segment / Contractor	Distance to site activities, m	Combined Activity Noise Levels at NSR, dBA	Daytime Limit	Nighttime Limit	Daytime Exceedance	Nighttime Exceedance	USFTA Rail Criteria Impact, Daytime	USFTA Rail Criteria Impact, Nighttime
1.	Kazybek Bek village	Contractor III	20	97	90	80	7	17	***Moderate***	***Major***
2.	Residential housing for employees at Kazybek Bek Station	Contractor III	15	100	90	80	10	20	***Moderate***	***Major***
3.	Srednyaya Shkola Stantsii, Kazybek Bek	Contractor III	240	70	90	80	No exceedance	No exceedance	***Negligible***	***Negligible***
4.	Sadik Pre-school, Kazybek Bek	Contractor III	210	71	90	80	No exceedance	No exceedance	***Negligible***	***Negligible***
5.	Unnamed cemetery, near Kazybek Bek	Contractor III	200	72	90	80	No exceedance	No exceedance	***Negligible***	***Negligible***
6.	Unnamed Christian cemetery, near Kazybek Bek	Contractor III	120	77	90	80	No exceedance	No exceedance	***Negligible***	***Negligible***
7.	Farmland and residential, near Kazybek Bek (Coordinates: 43°35'8.00"N, 76°21'53.00"E)	Segment A	185	77	90	80	No exceedance	No exceedance	***Negligible***	***Negligible***
8.	Farmland and residential, near Kazybek Bek (43°35'10.80"N, 76°24'59.20"E)	Segment A	180	77	90	80	No exceedance	No exceedance	***Negligible***	***Negligible***
9.	Farmland and residential, near Sorbulak Station (43°34'48.24"N, 76°39'10.85"E)	Segment B	190	77	90	80	No exceedance	No exceedance	***Negligible***	***Negligible***
10.	Residential housing for employees at Sorbulak Station	Segment B	15	105	90	80	15	25	***Major***	***Major***
11.	Residential housing for employees at Moyinkum Station	Segment D	15	100	90	80	10	20	***Major***	***Major***

NSR	Description	Segment / Contractor	Distance to site activities, m	Combined Activity Noise Levels at NSR, dBA	Daytime Limit	Nighttime Limit	Daytime Exceedance	Nighttime Exceedance	USFTA Rail Criteria Impact, Daytime	USFTA Rail Criteria Impact, Nighttime
12.	Residential housing for employees at Zhana Arna Station	Segment F	15	104	90	80	14	24	***Major***	***Major***
13.	Alatau City	Segment F	165	78	90	80	No exceedance	No exceedance	***Negligible***	***Negligible***
14.	Farmland and residential, near Zhetygen Station (43°37'17.44"N, 77° 4'42.71"E)	Contractor III	80	82	90	80	No exceedance	2	***Negligible***	***Negligible***
15.	Residential housing for employees at Zhetygen Station	Contractor III	15	100	90	80	10	20	***Major***	***Major***
16.	Alatau City	Contractor III	45	88	90	80	No exceedance	8	***Negligible***	***Moderate***

Mitigation Measures

Additional mitigation measures listed below can be applied to reduce overall construction noise. Some of the mitigation measures are taken from WB Toll Roads Guidance[88].

Develop a construction noise management plan that includes the following measures:

- Locating stationary equipment in acoustically treated enclosures, where practicable.
- Lining chutes and bins with damping material.
- Installing noise mufflers such as tubular, plate, cylindrical, or chamber air ducts lined with sound-absorbing materials for ventilation systems as per manufacturer recommendations.
- Installing temporary construction noise barriers along the border of the right-of-way (e.g., earthen mounds, walls, and vegetation).

To mitigate potential impacts from blasting activities, these mitigation measures shall be considered:

- Schedule blasting activities during daytime to minimise potential impacts on the surrounding areas.
- Optimise the number of holes blasted per shot and the total charge per blast.
- Noise meters and vibration meters should be placed at suitable locations (possibly at NSRs), and closely monitor during blasting activities.
- Use noise barrier / screen at the blasting site perimeter to reduce noise transmission.

Summary

The impact significance for noise impact from construction activities is summarised in **Table 6-43**.

TABLE 6-43: IMPACT SIGNIFICANCE OF NOISE FROM CONSTRUCTION ACTIVITES

<table>
<tr><th>Category</th><th>Impact before Mitigation</th><th>Residual Impact</th></tr>
<tr><td>Nature</td><td colspan="2">Negative</td></tr>
<tr><td>Type</td><td colspan="2">Direct</td></tr>
<tr><td>Duration</td><td colspan="2">Short-term</td></tr>
<tr><td>Extent</td><td colspan="2">Local</td></tr>
<tr><td>Scale</td><td colspan="2">Along the alignment, within 150m from site activities</td></tr>
<tr><td>Frequency</td><td colspan="2">Construction works for 24 months.</td></tr>
<tr><td rowspan="2">Significance</td><td>Major-Moderate within 50m from Stations</td><td>Minor</td></tr>
<tr><td colspan="2">Negligible for rest of the segment</td></tr>
</table>

[88] International Finance Corporation. (2007). *Environmental, health, and safety guidelines for toll roads*. Washington, D.C.: International Finance Corporation. Retrieved from https://www.ifc.org/content/dam/ifc/doc/2000/2007-toll-roads-ehs-guidelines-en.pdf

B) Vibration from Construction Activities

For assessing potential construction vibration damage to buildings, the estimated vibration levels produced by individual construction equipment are calculated using the USFTA Guideline.

Embedded Controls

- Vibration isolation through the use of vibration-damping supports, elastic gaskets, structural breaks, resonators, casings, and other methods.
- Use of vibration-damping foundations for compressor machines.
- Adoption of non-vibrating technological processes and units, along with the most efficient equipment placement schemes at production sites.
- Reduction of vibration during machine or equipment operation by enhancing the rigidity and vibration-damping properties of structures and materials and stabilizing the strength and other properties of components.
- Installation of equipment that excites vibration is carried out only on massive foundations that are not connected with the building structures.
- Using ground stabilisation methods to improve soil conditions and reduce the potential for vibration transmission through the ground.

Impact Magnitude

The damage assessment is conducted for each piece of vibration-heavy equipment separately. The calculated PPV (Peak Particle Velocity) and L_v (velocity levels) at 50m from the equipment are summarised below.

TABLE 6-44: CALCULATED CONSTRUCTION VIBRATION LEVELS AT 50M

Equipment	PPV at 25 ft, in/sec	L_v at 25 ft, VdB	PPV_{equip} at 50m, in/sec	L_v at 50m, VdB
Limits for Type III. Non-engineered timber and masonry buildings			**0.2**	**94**
Excavator	1.518	112	0.090	87.5
Loader	0.076	86	0.005	61.5
Bulldozer	0.089	87	0.005	62.5
Thrall	0.035	79	0.002	54.5
Pile Driver	1.518	112	0.090	87.5
Drilling	0.089	87	0.005	62.5

The calculated PPV_{equip} and L_v of each vibration inducing equipment are well under the criteria for category III buildings at 50m. To ensure that construction vibration levels remain within acceptable limits, the minimum buffer distances from the equipment are calculated. These distances define the area where construction vibration levels are within the established limits. The results are presented in **Table 6-45.**

TABLE 6-45: CALCULATED CONSTRUCTION VIBRATION – MINIMUM BUFFER FROM EQUIPMENT

Equipment	Minimum Buffer Distance from equipment, m	PPV at 25 ft, in/sec	L_v at distance, VdB
Limits for Type III. Non-engineered timber and masonry buildings		**0.2**	**94**
Excavator	**30**	0.19	94
Loader	**5**	0.14	91
Bulldozer	**5**	0.17	92
Thrall	**3**	0.14	91
Pile Driver	**30**	0.19	94
Drilling	**5**	0.17	92

For heavy equipment such as excavator and pile driver, a minimum of **30m** is required to keep the vibration within limits of category III buildings .

Impact Significance

Based on the above analysis, the project’s potential impacts on vibration sensitive receptors resulting from vibration during construction will be minor-negligible in magnitude depending on the distance of the receptors from the Project, local in extent, and short-term in duration, with an overall pre-mitigation significance of **Negligible** for receptors beyond 30m from the equipment in the daytime. The impact significance within **30m** is **Minor** to **Major** depending on distance due to the exceedance of vibration limit from excavator and pile driver.

Additionally, it is important to note that the area within 30m of the equipment is highly likely to fall within the construction site boundary, ensuring there are no NSRs within this zone.

Mitigation Measures

As the pre-mitigated impact is Negligible, no additional mitigation measure is required.

Summary

The impact significance for vibration impact from construction activities is summarised below.

TABLE 6-46: IMPACT SIGNIFICANCE OF VIBRATION FROM CONSTRUCTION ACTIVITES

Category	Impact before Mitigation	Residual Impact
Nature	Negative	
Type	Direct	
Duration	Short-term	
Extent	Local	

Category	Impact before Mitigation	Residual Impact
Scale	Within 30m from construction activities	
Frequency	Construction works for 24 months.	
Significance	**Negligible beyond 30m from construction equipment**	

6.3.6.2 OPERATIONAL PHASE

A) Noise from train operation

Operational noise from train operation is assessed using USFTA Guideline detailed in **Section 6.3.5.4**.

Embedded Controls

1. Train Speed Adjustment

The mitigation measure of train speed adjustment aims to reduce the noise generated by train operation by strategically controlling train speeds based on proximity to sensitive receptors, such as residential areas, and their surrounding environment. This approach is designed to minimise noise impact during operation, especially when trains pass through areas with noise-sensitive locations.

The average train speed is designed to be 60km/hr, while the speed of the train is reduced to 40km/hr when it enters the 1.5km zone from the train stations. The train speed will be further reduced to 20km/hr when it's approaching the stations. The train speed adjustment measure strategically reduces train speeds near sensitive receptors (settlements) to minimise noise exposure while balancing operational efficiency.

2. Train Track Design

Based on Poligram's report on operation design, the use of 30cm gravel and sand ballast on the station tracks, constructed on ordinary soil, is a key component of the noise and vibration mitigation strategy for the railway. The ballast serves multiple critical functions that significantly contribute to reducing the environmental impacts of train operations. The gravel and sand ballast provides an effective medium for vibration dissipation. The ballast absorbs and diffuses the vibrations generated by the movement of trains, preventing them from traveling through the ground. The ballast also acts as a buffer between the train wheels and the underlying ground. This is particularly crucial for minimising ground-borne noise—the low-frequency sounds that travel through the soil and radiate as sound inside buildings.

3. Regular Maintenance

Regular check-up and maintenance every year of rail track shall be conducted to ensure smooth rail surfaces and proper wheel alignment, thus reducing operation noise and vibration impacts. This ongoing maintenance strategy aims to preserve the quality of the track and associated components, ensuring smooth operation and limiting disturbances to the surrounding environment and communities.

Impact Magnitude

$L_{Aeq(1hr)}$ at daytime and nighttime were calculated to determine the operation noise levels at NSRs from operation of trains with the different speeds. The speed that is used for calculation are based on the location of the NSR along the train alignment and the distance to the train stations. Refer to **Section 6.3.5.4** for the input parameters and assumptions. Refer to **Section 6.3.5.4** $L_{Aeq(1hr)}$ at daytime and nighttime were calculated to determine the operation noise levels at NSRs from operation of trains with the different speeds. The speed that is used for calculation are based on the location of the NSR along the train alignment and the distance to the train stations. for the input parameters and assumptions.

Table 6-47 presents the predicted noise levels at varying distances from the railway centreline. As the settlements near Kazybek Bek and Zhetygen Stations fall within the 40km/hr speed zone, the noise levels of 40km/hr speed shall be taken to assess operation noise impact to the settlements. The results indicate that receptors located within 40m from the railway centreline will experience a **Moderate Impact**, while receptors situated beyond 100m from the railway centreline will have **No Impact**.

TABLE 6-47: DISTANCE TO RAILWAY AND PREDICTED NOISE LEVELS

Distance to railway centreline, m	Estimated combined noise level $L_{Aeq(1hr)}$ at NSR, dBA		
	60km/hr	40km/hr	20km/hr
20	66	63	57
40 [a]	61	58	53
60	59	56	50
80	57	54	48
100 [b]	55	52	47
120	54	51	46
140	53	50	45
160	52	49	44
180	52	48	43
200	51	48	42
220	50	47	42
240	50	47	41
260	49	46	41
280	49	46	40
300	48	45	40
320	48	45	39
340	48	44	39
360	47	44	39
380	47	44	38

Distance to railway centreline, m	Estimated combined noise level $L_{Aeq(1hr)}$ at NSR, dBA		
	60km/hr	40km/hr	20km/hr
400	46	43	38
420	46	43	38
440	46	43	37
460	46	42	37
480	45	42	37
500	45	42	36

Note: The impact assessment is determined with 54dBA baseline noise level.
[a] Receptors within 40m from railway centreline will be in **Moderate Impact (55-61dBA)**.
[b] Receptors beyond 100m from railway centreline will be **No Impact (<54dBA)**.

Table 6-48 outlines the minimum buffer distances required from the railway centreline to mitigate noise impacts based on train speed, following USFTA standards. To achieve a **No Impact** classification, where noise levels remain below 54dBA, receptors must be located at least 140m away for trains traveling at 60km/hr, 100m for trains at 40km/hr, and 40m for trains at 20km/hr. Refer to the area within green line in outlines the minimum buffer distances required from the railway centreline to mitigate noise impacts based on train speed, following USFTA standards. To achieve a **No Impact** classification, where noise levels remain below 54dBA, receptors must be located at least 140m away for trains traveling at 60km/hr, 100m for trains at 40km/hr, and 40m for trains at 20km/hr. **Figure 6-10** and **Figure 6-11**.

TABLE 6-48: MINIMUM BUFFER DISTANCE FROM RAILWAY CENTRE VS NOISE IMPACT

USFTA Standards	60km/hr	40km/hr	20km/hr
Distance to achieve **No Impact** (<54dBA), m	140	100	40
Distance to achieve **Moderate Impact** (55-61dBA), m	60	40	20

As of March 2025, approximately 3km along Kazybek Bek and 6.5km along Zhetygen are inhabited. However, train operation noise will significantly affect a 1km stretch along Kazybek Bek and a 2.25km stretch along Zhetygen. The number of structures near Zhetygen and Kazybek Bek Stations that are in the **Moderate** impact zone are estimated and summarised in **Table 6-49**. Note that the estimated number of structures may include commercial / industrial / non-residential / KTZ-owned structures, the exact number of residential houses are uncertain.

TABLE 6-49: NUMBER OF STRUCTURES UNDER OPERATION NOISE IMPACT

Impacted Area	Estimated Number of structures
Kazybek Bek Station	Estimated 12no.
Zhetygen Station	3 scattered structures, 3 clusters (estimated 21no. structures)

The potential noise impacts to the residential developments are detailed below.

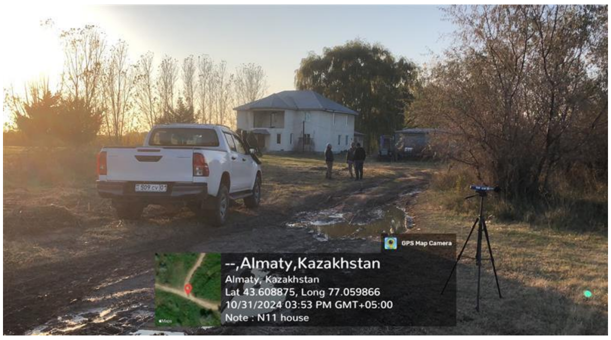
Noise Impacts to Residential developments

Noise impacts to residential developments depends on the material type and condition of the houses. From the noise survey conducted in October 2024, it is noted that most residential houses in Kazakhstan are mainly built with concrete / timber walls with corrugated metal roof. Site photos were taken from the noise measurement locations.

At V01A near Kazybek Bek, a residential house is found near the existing train track. The house shown in the photos is a small, single-story structure with a corrugated metal roof. The exterior walls show signs of wear, including peeling paint and possible damage near the windows. The windows lack shutters and seem to have minimal or no visible frames or coverings.

FIGURE 6-9: PHOTO OF NOISE MEASUREMENT LOCATION V01A

The photos below showed the location N11 (house near Zhetygen). Similar structure and material are used for these houses.



Due to the close proximity of the houses to the railway and the general structural integrity of the houses are not designed for soundproofing railway noises, noise impact is inevitable for houses close to the railway.

Sleep Disturbance

IFC does not have a specific guideline for sleep disturbance, yet it's generally aligned with World Health Organisation (WHO). According to WHO's Guidelines for Community Noise[89], to prevent serious annoyance during the daytime, the sound pressure level (L_{Aeq}) on outdoor

[89] World Health Organization. (1999). *Guidelines for community noise*. Retrieved from https://docs.wind-watch.org/WHO-Communitynoise.pdf

living areas (such as balconies, terraces) should not exceed 55dBA for steady, continuous noise. For moderate annoyance, the outdoor sound pressure level should remain below 50dBA.

At night, the sound pressure level (L_{Aeq}) outside the façades of living spaces should not exceed 45dBA or 60dBA LAmax to enable people to sleep with bedroom windows open. These values assume a 15dB reduction in noise levels from outside to inside with windows partially open.

Predicted Noise at NSRs

The predicted operation noise levels at NSRs results are summarised in **Table 6-50**. Due to the various train speed design, the impact on most selected NSRs is **Negligible**.

However, the residential housing buildings for station employees (NSRs #2, 10, 11, 12, and 15) experience a **Moderate** impact as they are located very close to the train station. Additionally, NSR #14 is also categorised as having a **Moderate** impact due to its location further from the train station, where the train speed is 60 km/hr.

For NSR#1, as the distance is at 20m, the predicted noise level is 63dBA, which is considered having **severe** impact.

TABLE 6-50: ESTIMATED COMBINED NOISE LEVELS AT NSRS AND PRE-MITIGATION IMPACT SIGNIFICANCE OF OPERATION NOISE FROM FREIGHT TRAINS

NSR	Description	Speed, km/hr	Distance to railway centre, m	Estimated noise level $L_{Aeq(1hr)}$ at NSR, dBA	Existing Noise Exposure $L_{Aeq(1hr)}$, dBA		Land-use Category [d]	USFTA Rail Criteria Impact	
					daytime	Nighttime		daytime	Nighttime
1.	Kazybek Bek village	40	20	63	54	54	2- Residential	***Severe***	***Severe***
2.	Residential housing for employees at Kazybek Bek Station	20	15	59	54	54	2- Residential	***Moderate***	***Moderate***
3.	Srednyaya Shkola Stantsii, Kazybek Bek	40	240	47	54	54	3 - School	***No Impact***	***No Impact***
4.	Sadik Pre-school, Kazybek Bek	40	210	47	54	54	3 - School	***No Impact***	***No Impact***
5.	Unnamed cemetery, near Kazybek Bek	40	200	48	54	54	3 - Cemetery	***No Impact***	***No Impact***
6.	Unnamed Christian cemetery, near Kazybek Bek	40	120	51	54	54	3 - Cemetery	***No Impact***	***No Impact***
7.	Farmland and residential, near Kazybek Bek (Coordinates: 43°35'8.00"N, 76°21'53.00"E)	60	185	51	51	46	2 - Residential	***No Impact***	***No Impact***
8.	Farmland and residential, near Kazybek Bek (43°35'10.80"N, 76°24'59.20"E)	60	180	52	51	46	2 - Residential	***No Impact***	***No Impact***
9.	Farmland and residential, near Sorbulak Station (43°34'48.24"N, 76°39'10.85"E)	60	190	51	51	46	2 - Residential	***No Impact***	***No Impact***
10.	Residential housing for employees at Sorbulak Station	20	15	59	51	46	2 - Residential	***Moderate***	***Moderate***
11.	Residential housing for employees at Moyinkum Station	20	15	59	51	46	2 - Residential	***Moderate***	***Moderate***
12.	Residential housing for employees at Zhana Arna Station	20	15	59	51	46	2 - Residential	***Moderate***	***Moderate***
13.	Alatau City	60	165	52	51	46	2- Residential	***No Impact***	***No Impact***
14.	Farmland and residential, near Zhetygen Station (43°37'17.44"N, 77° 4'42.71"E)	60	80	57	54	*62*	2- Residential	***Moderate***	***No Impact***
15.	Residential housing for employees at Zhetygen Station	20	15	59	54	*62*	2- Residential	***Moderate***	***Moderate***
16.	Alatau City	20	45	52	54	*62*	2- Residential	***No Impact***	***No Impact***

Note:
[a] Based on the 1-hour baseline measurement in **Section 6.3.4.3** the existing noise exposure for NSRs near Kazybek Bek Station will adopt 54dBA as daytime and nighttime baseline.
[b] NSRs near Zhetygen Station will adopt 54dBA as daytime and 62dBA as nighttime baseline.
[c] For settlements and other NSRs not in close proximity of any station, the baseline noise levels of 51dBA and 54dBA as daytime and nighttime baseline will be adopted respectively.
[d] Land-use category 2 is applicable to residential land use and category 3 is applicable to institutional land uses with primarily daytime and evening time use. Referenced from USFTA Table 4-3 Land Use Categories and Metrics for Transit Noise Impact Criteria.

Impact Significance

Based on the above analysis, the project's potential impacts on noise sensitive receptors resulting from noise during train operation will be negligible-severe in magnitude depending on the distance of the receptors from the Project and train speed, local in extent, and long-term in duration, with an overall pre-mitigation significance of **Negligible** to **Major**.

Mitigation Measures

1. Noise Barriers

Due to the major operational noise impacts predicted from the freight trains, noise barriers will be installed to reduce noise levels at residences adversely affected by the railway noise at Kazybek Bek and Zhetygen.

Figure 6-10 showed the impacted area and the proposed barrier location at Kazybek Bek. The proposed length of barrier is 1km at the northern side of track.

FIGURE 6-10: KAZYBEK BEK STATION IMPACT ZONE AND PROPOSED BARRIER LOCATION

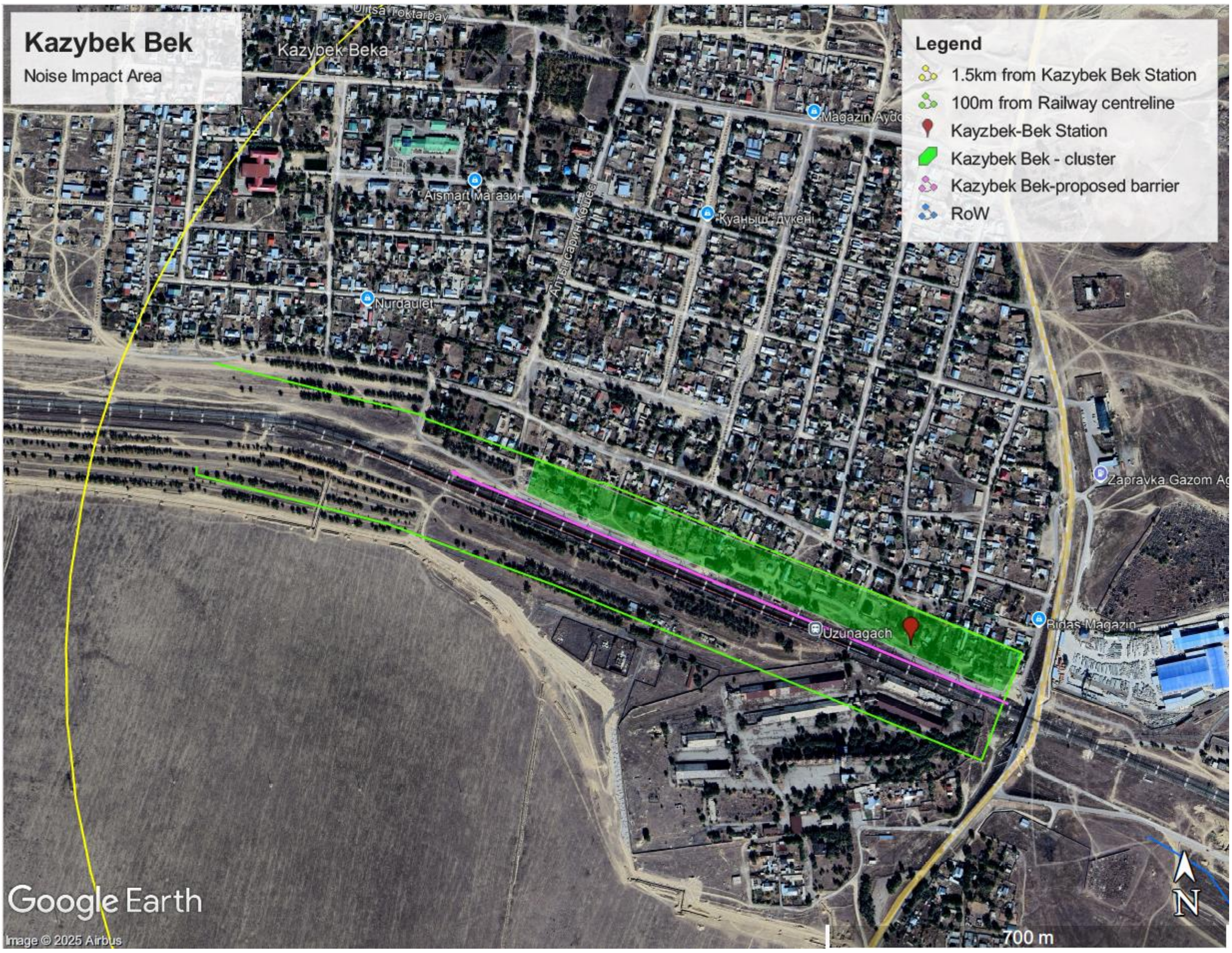
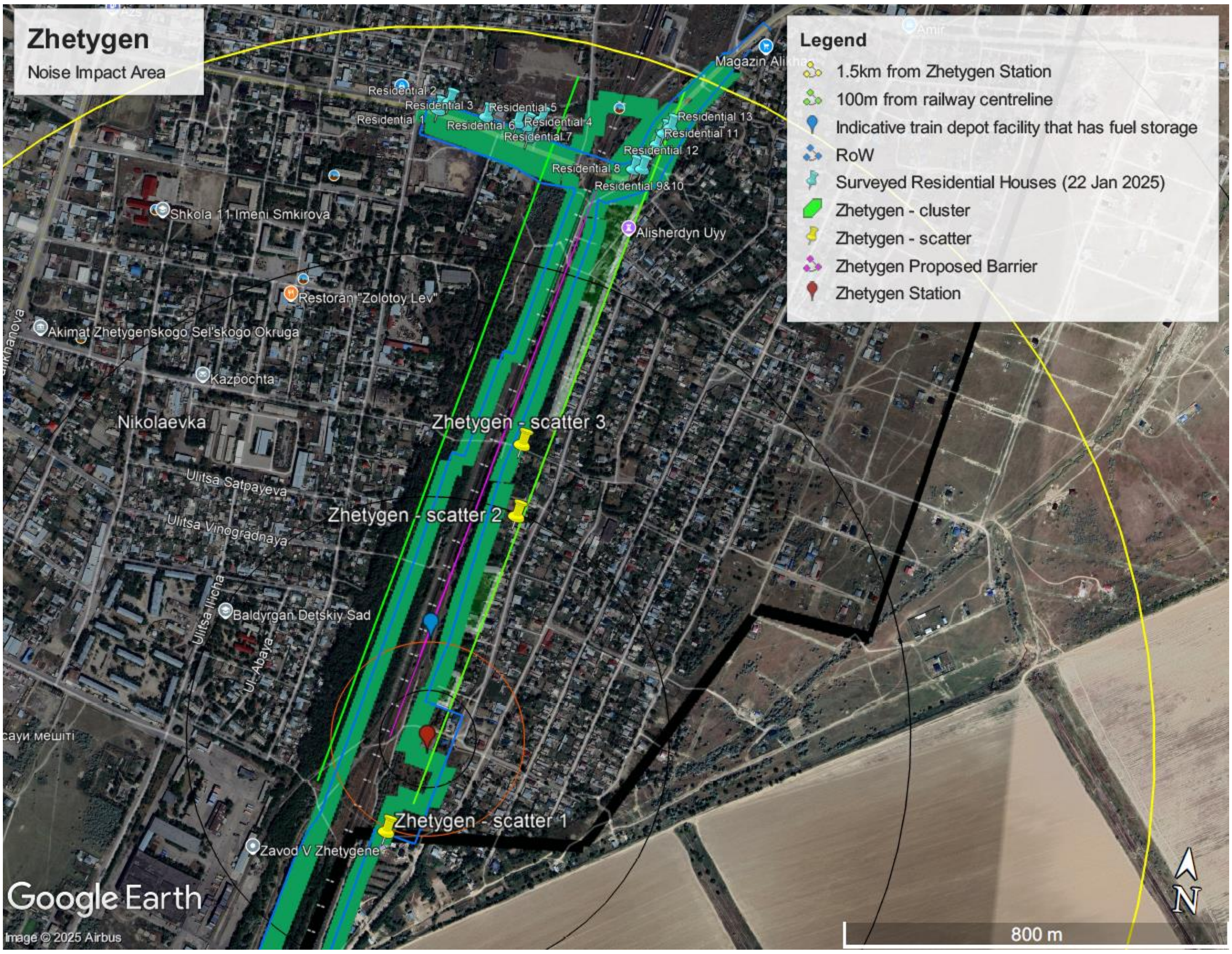


Figure 6-11 showed the impacted area and the proposed barrier location at Zhetygen. The proposed length of barrier for Zhetygen Station is 2.25km at the eastern side of track.

FIGURE 6-11: ZHETYGEN STATION IMPACT ZONE AND PROPOSED BARRIER LOCATION



There are different types of materials to be used as the noise barrier material including (i) Polycarbonate, (ii) acrylic, (iii) concrete or (iv) composite panels with absorption infill.

To ensure effective noise mitigation, plastic barriers must meet the following criteria:

- A minimum surface density of 10 kg/m² is required.
- The Sound Transmission Class (STC) rating must be at least 10 points higher than the required noise reduction at residential areas. For instance, if a 10 dB(A) noise reduction is necessary, the trackside barrier should have a minimum STC rating of 20. For this Project, the minimum required STC is 25.
- It should be noted that STC ratings above 33 do not provide additional noise reduction benefits.

Some examples of the material design that can meet the above requirements include:

- 8mm thick Polycarbonate with a surface density of 10 kg/m² and an STC rating of 30.
- 15mm thick Acrylic with a surface density of 18 kg/m² and an STC rating of 32.
- 100mm light concrete, with a surface density of 161 kg/m² and an STC rating of 36.

Noise barriers primarily function as acoustic shields rather than sound absorbers, with both plastic and painted concrete barriers exhibiting acoustically reflective properties unless absorptive treatments are applied. When implementing transparent plastic barriers, additional considerations include glare from sunlight at certain angles, which may impact visibility, potential bird collisions, which may necessitate the use of thin opaque strips, and maintenance requirements, as regular cleaning is necessary to preserve transparency.

Noise barrier maintenance costs should be considered as part of the long-term operational expenses for any project involving noise mitigation. These costs typically include routine inspections, repairs, cleaning, and potential upgrades to ensure the barriers remain effective over time. Factors such as the type of materials used, environmental conditions, and the level of wear and tear from weather or accidental damage can impact maintenance frequency and cost. Additionally, regular maintenance helps preserve the barrier’s noise reduction performance, ensuring compliance with noise regulations and preventing excessive noise exposure to surrounding communities. Therefore, while the initial installation of noise barriers can be costly, maintaining their functionality is crucial for ensuring their ongoing effectiveness and minimizing long-term environmental impact.

The performance of the noise barriers should be designed to achieve sufficient noise reduction. According to the required SPZ from National Sanitary Rule (2022), a 100-meter buffer zone should be maintained, within which residential housing is not permitted. However, there is currently no available information on how the Developer plans to enforce or implement this requirement, particularly in relation to the expansion of existing stations and the development of new ones. Depending on the mitigation measures applied, the required SPZ may be reduced to 50 meters in accordance with the sanitary rules.

it is important to acknowledge that additional studies will be required to further refine the design of the noise barriers. These studies should involve detailed site-specific measurements and modelling to accurately assess the effectiveness of the proposed barriers in mitigating noise impacts. By incorporating factors such as local topography, barrier materials, and the precise location of sensitive receptors, these additional studies will ensure that the noise barriers are optimised for maximum noise reduction. This approach will help to achieve more accurate and reliable results, ensuring that noise levels remain within acceptable thresholds and that the project minimises its impact on surrounding communities.

2. Equipment Selection

Based on National EIA, measures to minimise noise levels for stationary operational equipment shall focus on reducing noise at the source, implementing sound-reflecting or sound-absorbing barriers along the sound propagation path when necessary, and applying noise protection measures at the affected facility. According to the requirements of GOST 12.1.003-83 *"SSBT. Noise. General Safety Requirements"*, sound levels in workplaces should not exceed 85dB. Therefore, it is recommended to obtain equipment with noise emission <85dB.

Recommended Practices

1. Noise Monitoring

To effectively manage and mitigate operational noise, annual noise monitoring will be a beneficial component of the project's environmental management plan. Short-term attended noise measurements will be conducted during train passbys. These measurements will focus on capturing the Sound Exposure Level (SEL), which quantifies the noise energy produced by a single train event at the closest NSR from Kazybek Bek and Zhetygen stations.

By capturing the SEL, the noise monitoring process provides an accurate snapshot of the noise emitted during train passbys. This data will be instrumental in calculating additional noise metrics, such as L_{eq}, by factoring in the train frequency. This conversion allows for a more comprehensive understanding of the cumulative noise impacts over time, enabling more precise and effective noise management.

The noise monitoring data will not only support the ongoing management of long-term noise impacts but also ensure that noise levels remain within the acceptable limits set by local regulations and guidelines.

2. Community Management

In the event of noise complaints from local residents or other stakeholders, the noise monitoring system will be extended to address and investigate the sources of these complaints. This will involve additional targeted noise measurements at affected receptors to assess the impact and determine whether the noise levels exceed the acceptable thresholds. If necessary, further mitigation measures will be implemented to resolve the issue.

3. Sound insulation at Receptors / Houses

As discussed above, the existing houses near the Project alignment are not designed for soundproofing. Depending on if the impacted structures are owned by KTZ, the following mitigation measures are recommended for residential houses for improvement.

- Install soundproof windows and doors to reduce indoor noise levels.
- Add acoustic insulation to walls, particularly those facing the railway.
- Seal gaps and cracks in the building envelope to minimise noise penetration.
- Erect noise barriers or walls between the railway and the house.
- If noise mitigation is insufficient or costly, relocating to a location farther from the railway might be a long-term solution.

Summary

The impact significance for noise impact from train operation is summarised below.

TABLE 6-51: IMPACT SIGNIFICANCE OF NOISE FROM OPERATIONAL ROLLING STOCK

Category	Impact before Mitigation	Residual Impact
Nature	Negative	
Type	Direct	
Duration	Short-term	
Extent	Local	
Scale	Along the alignment	
Frequency	Throughout operations phase when train pass by	

Category	Impact before Mitigation	Residual Impact
Significance (for trains operating at 60 km/hr)	**Major within 40m from railway centreline**	**Minor**
	Moderate between 40m to 140m from railway centreline	
	Negligible beyond 140m from railway centreline	
Significance (for trains operating at 40 km/hr)	**Major within 30m from railway centreline**	**Minor**
	Moderate between 30m to 80m from railway centreline	
	Negligible beyond 80m from railway centreline	
Significance (for trains operating at 20 km/hr)	**Major within 10m from railway centreline**	**Minor**
	Moderate between 10m to 40m from railway centreline	
	Negligible beyond 40m from railway centreline	

B) Noise from train stations

Embedded Controls

1. Noise Barrier at Kazybek Bek Station

According to the National EIA, noise control measures at the facility include the installation of a noise barrier at the Kazybek Bek Station. The noise barrier "Tuten" is designed to be 90m in length and 4.2m high along Kazybek Bek Street, situated between residential buildings and the wheel plant, as well as the sewage pumping station.

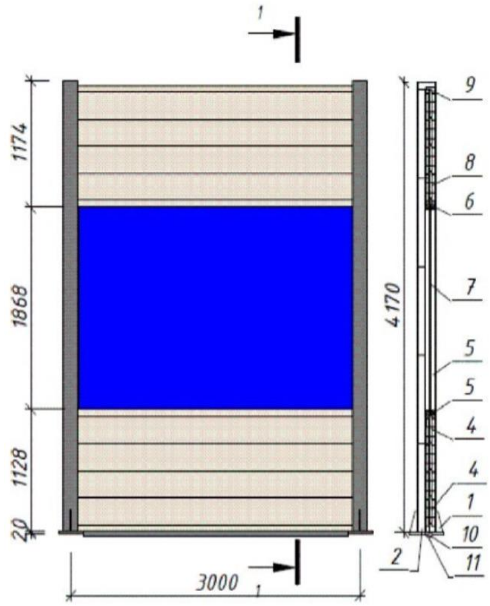
The design of the noise barrier is presented in **Figure 6-12**. The noise barrier height is at approximately 4.2m and made mainly with Polyphenylene Methyl Amide (PPMA), which is weather-resistant.

FIGURE 6-12: NOISE BARRIER DESIGN

Sound Insulation Panel "Tumen"

Specifications of Materials for the Sound Insulation Screen Section

No.	Name	Unit of Measurement	Quantity
1	Frame C-47.20(1)	pcs	2
2	Adjacent Element, L=0.82 m	pcs	10
3	PO-5A, L=2.98 m	pcs	1
4	PO-U2.3, L=2.98 m	pcs	4
5	PO-U3-1, L=1.87 m	pcs	1
6	PO-U3-1, L=2.98 m	pcs	1
7	Panel PPMA	pcs	4
8	PPU-2.2, L=2.98 m	pcs	2
9	PO-6, L=2.98 m	pcs	1
10	Polyethylene Width, L=2.75 m	pcs	1
11	Oil-resistant Rubber, t=2 mm	pcs	1



Source: KTZ

2. <u>Ventilation Noise at Train Station</u>

For ventilation systems, noise mufflers will include tubular, plate, cylindrical, and chamber air ducts lined internally with sound-absorbing materials, along with noise-reducing duct turns. Additionally, compliance with current regulations, including the use of machinery and equipment that meet GOST standards, serves as the primary measure for protecting personnel from noise exposure.

Impact Magnitude

The resultant noise levels from train station operation at Kazybek Bek and Zhetygen Stations to the residential areas within 200m are simulated in the National EIA.

The highest predicted noise levels at residential areas are summarised in **Table 6-52** and the equivalent noise level contour are shown in **Figure 6-13** and **Figure 6-14**. The highest predicted noise level at residential area at Kazybek Bek is 49dBA and 22dBA at Zhetygen, which are lower than both daytime and nighttime WBG General EHS guidelines criteria set out in **Table 6-32**. However, there is a 4dB exceedance at Kazybek Bek Station during nighttime comparing with the national standards set out in **Table 6-25**.

TABLE 6-52: OUTDOOR NOISE SOURCES AND PREDICTED EQUIVALENT NOISE LEVELS

Station	Outdoor Noise Sources	Highest predicted noise level at Residential area, dBA	National Standards		WBG General EHS Guidelines	
			$L_{Aeq(1hr)}$ Criteria, Daytime, dBA	$L_{Aeq(1hr)}$ Criteria, Nighttime, dBA [a]	$L_{Aeq(1hr)}$ Criteria, Daytime, dBA	$L_{Aeq(1hr)}$ Criteria, Nighttime, dBA [a]
Kazybek Bek	Centrifugal fan, pumping stations and transformer	49	55	45	55	57

Station	Outdoor Noise Sources	Highest predicted noise level at Residential area, dBA	National Standards		WBG General EHS Guidelines	
			$L_{Aeq(1hr)}$ Criteria, Daytime, dBA	$L_{Aeq(1hr)}$ Criteria, Nighttime, dBA [a]	$L_{Aeq(1hr)}$ Criteria, Daytime, dBA	$L_{Aeq(1hr)}$ Criteria, Nighttime, dBA [a]
Zhetygen	Car inspection post, boiler room, cargo equipment, compressor	22	55	45	55	65

Note:
[a] The night criteria at these locations are 3dB above measured baseline level as indicated in **Table 6-32**.

FIGURE 6-13: PREDICTED EQUIVALENT NOISE LEVEL AT KAZYBEK BEK STATION

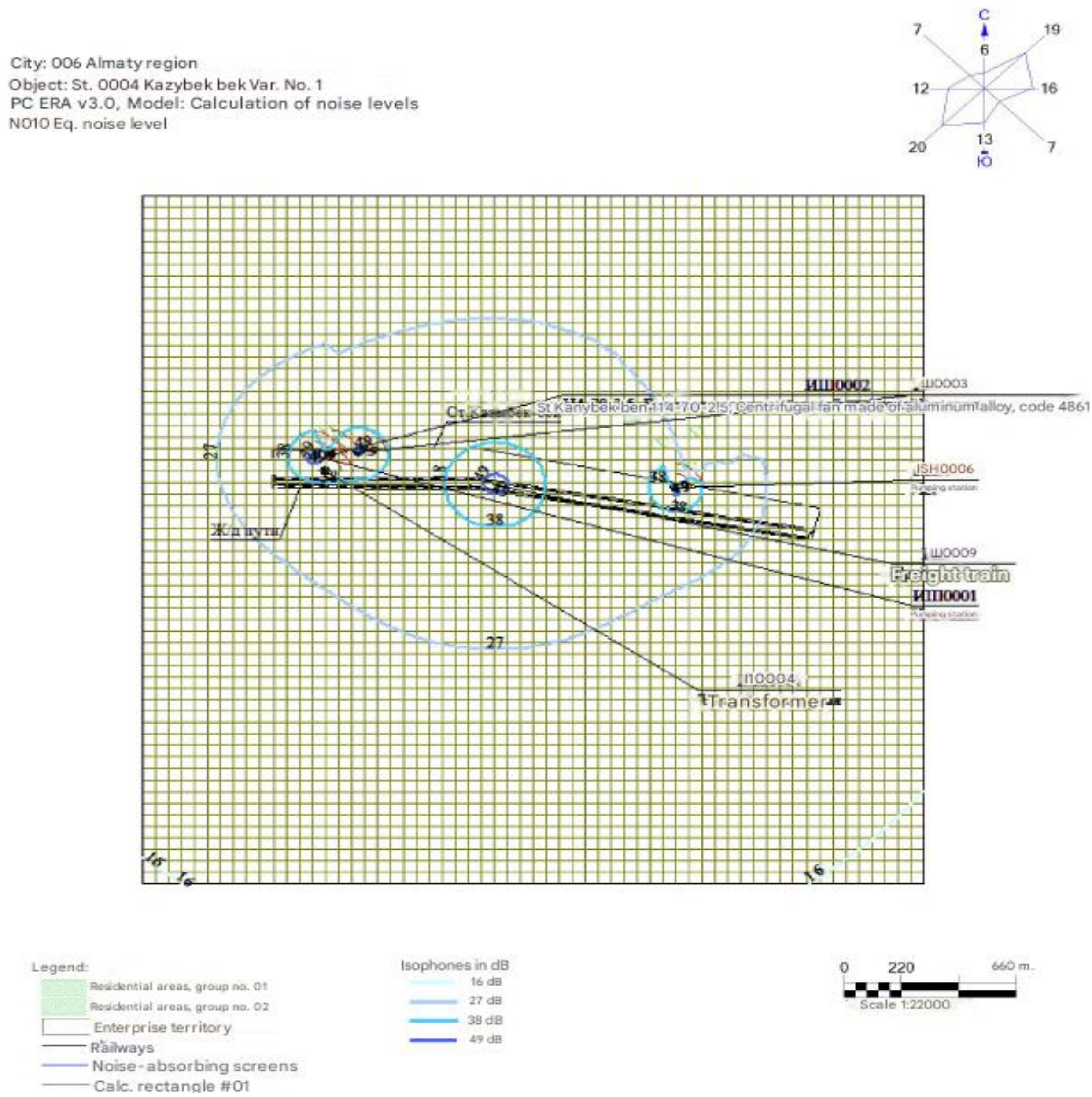
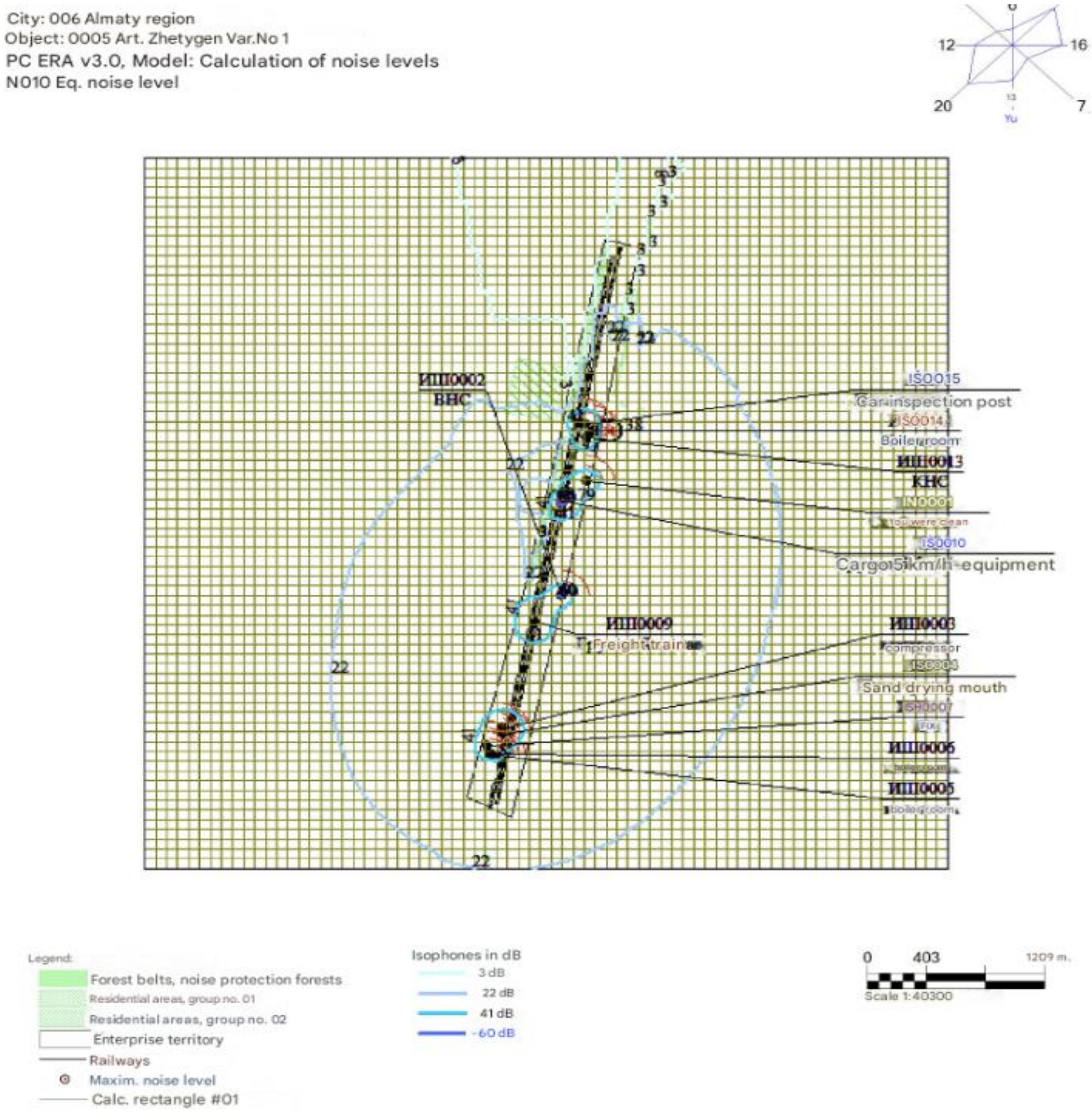


FIGURE 6-14: PREDICTED EQUIVALENT NOISE LEVEL AT ZHETYGEN STATION



Impact Significance

Based on the results, the operation noise from Kazybek Bek and Zhetygen Stations are both within the daytime and nighttime residential noise criteria. The project’s potential impacts on noise sensitive receptors resulting from noise during operation of the train stations will be Negligible in magnitude, local in extent, and long-term in duration, with an overall pre-mitigation significance of **Negligible**.

Mitigation Measures

As the pre-mitigated impact is Negligible, no additional mitigation measure is required.

Summary

The impact significance for noise impact from the operation of train stations is summarised below.

TABLE 6-53: IMPACT SIGNIFICANCE OF NOISE FROM OPERATION OF TRAIN STATIONS

Category	Impact before Mitigation	Residual Impact
Nature	Negative	
Type	Direct	
Duration	Long-term	
Extent	Local	
Scale	Within 200m from stations	
Frequency	Continuous	
Significance	**Negligible**	

C) Vibration from freight trains

Vibration generated from the operation of freight train is assessed in this section.

Embedded Controls

The control measures associated with noise are applicable to vibration, refer to **Section 6.3.6.2**.

According to the National EIA, when selecting machines and equipment for the designed facility, priority is given to kinematic and technological systems that minimise or eliminate dynamic processes caused by shocks, sudden accelerations, and similar factors.

Additionally, it is recommended to avoid resonant operating modes by selecting operational settings that carefully consider the natural frequencies of the machines and mechanisms.

Impact Magnitude

The ground surface vibration from the base curve of locomotive freight is calculated. The adjusted vibration levels at different speeds for different distances from railway centreline are computed below **Table 6-54**.

TABLE 6-54: CALCULATED VIBRATION LEVEL FROM OPERATION OF RAILWAYS

Distance from railway centreline, m	Vibration Level Base Curve, VdB (80km/hr)	Adjusted Vibration Level, VdB		
		60 km/hr	40 km/hr	20 km/hr
GBV Impact Levels Criteria	75			
10	79	76.7	73.2	73.2
20	77	74.1	70.6	70.6
30	75	72.6	69.1	69.1

Distance from railway centreline, m	Vibration Level Base Curve, VdB (80km/hr)	Adjusted Vibration Level, VdB		
		60 km/hr	40 km/hr	20 km/hr
50	73	70.7	67.2	67.2
100	71	68.1	64.6	64.6
150	69	66.6	63.1	63.1

As the total number of trains run about 54 times a day, it is considered as occasional events. Based on **Table 6-30**, the vibration limits for occasional events at residential area is at 75VdB.

Due to the speed design, the vibration level at 10m from railway centreline with 60km/hr speed exceeds the 75VdB criteria and no exceedance beyond 20m from the railway centreline for the 40km/hr and 20km/hr. As the predicted vibration levels is below 75VdB for the closest receptor, the impact to the residents shall be negligible.

The minimum buffer distance from the rail centre is computed to establish the area which the operation vibration levels from trains are under the limit. To keep the vibration levels under the limit of 75VdB, a minimum distance of 20m is required for the operational speed of 60km/hr.

Impact Significance

Based on the above analysis, the project's potential impacts on residential receptors resulting from vibration during operation will be negligible in magnitude depending on the distance of the receptors from the Project, local in extent, and long-term in duration, with an overall pre-mitigation significance of **Negligible** for receptors further than 30m from the railway centreline.

Mitigation Measures

As the pre-mitigated impact is Negligible, no additional mitigation measure is required.

Summary

The impact significance for vibration impact from the operation of freight train is summarised below.

TABLE 6-55: IMPACT SIGNIFICANCE OF VIBRATION FROM OPERATION OF FREIGHT TRAIN

Category	Impact before Mitigation	Residual Impact
Nature	Negative	
Type	Direct	
Duration	Long-term	
Extent	Local	
Scale	Along train alignment	
Frequency	Throughout operations phase when train pass by	
Significance	**Negligible**	

6.4 SURFACE WATER

6.4.1 INTRODUCTION

This section presents the surface water quality characteristics, and the hydrological and hydraulic results conducted for the waterways that intersect with the rail alignment within the Project AoI (**Figure 6-1**). The approach for the surface water and hydrological assessment was:

- The National EIA and technical studies conducted for the Project, supported by secondary data and visual observations gathered during the Supplementary ESIA site visit were used to establish the water quality conditions of the waterways in the absence of baseline sampling.
- The results of the technical studies are used to assess the changes on the water quality characteristics and hydrological regime of the project due to the Projects construction and operational activities.
- These potential impacts were also evaluated in consideration of any embedded control and good practices. Where needed, additional mitigation measures for each of the identified impacts were developed (beyond the embedded controls) to reduce the remaining impacts.

6.4.1.1 LIMITATIONS

The Surface Water Section was prepared based on the following limitations:

- The assessment was conducted based on Project information made available to ERM by AIIB, IFC, KTZ and subcontractors, site visit findings and readily available public information within the time limits of the study.
- No quantitative early-stage primary data collection was conducted by ERM for the Project.
- No quantitative assessments such as hydrological and flood modelling were conducted by ERM for the Project.

6.4.2 APPLICABLE REFERENCE FRAMEWORK

Applicable laws, directives, policy and guidance for surface water impacts are outlined in **Table 6-56.**

TABLE 6-56: SURFACE WATER APPLICABLE REGULATIONS AND GUIDELINES

Title	Year
Law	
Environmental Code of the Republic of Kazakhstan No. 400-VI ZRK.	2021
The Water Code of the Republic of Kazakhstan.	2024
Order of the Minister of Agriculture of the Republic of Kazakhstan dated 18 May 2015 No 19-1/446 "On Approval of the Rules for the Establishment of Water Protection Zones and Strips".	2015
Hygienic Standards for Safety Indicators of Household, Drinking and Cultural and Domestic Water Use” (Order of the Minister of Health of the Republic of Kazakhstan dated 24 November 2022 No. KR DSM-138. Registered with the	2022

Title	Year
Ministry of Justice of the Republic of Kazakhstan on 25 November 2022 No. 30713).	
Methodology for determining emission standards into the environment (Order of the Minister of Ecology, Geology and Natural Resources of the Republic of Kazakhstan No. 63. Registered with the Ministry of Justice of the Republic of Kazakhstan No. 22317).	2021
Technical Standard of KAZ ISO 16075-2:2020 "Guidelines for treated wastewater use for irrigation projects".	2020
Policy	
IFC Environmental, Health, and Safety Guidelines for Railways.	2007
IFC General Environmental, Health, and Safety (EHS) Guidelines.	2007

The various water quality and effluent standards applicable to the Project are provided in **Table 6-57** and **Table 6-58**.

TABLE 6-57: PROJECT DISCHARGE STANDARDS FOR TREATED SANITARY SEWAGE

Parameter	Unit	Value
pH	-	6-9
BOD5	mg/l	30
COD	mg/l	125
Total Nitrogen	mg/l	10
Total Phosphorus	mg/l	2
Oil and Grease	mg/l	10
Total Suspended Solids	mg/l	50
Total Coliform Bacteria	per 100ml	400
Source: IFC General EHS Guidelines, 2007		

TABLE 6-58: PROJECT DISCHARGE STANDARDS FOR AMBIENT WATER QUALITY

Parameter	Unit	$MPC_{domestic}$ [a]	$MPC_{fishery}$ [b]
pH	-	6 – 9	-
Turbidity	NTU	2.6	-
Colour	Units	20	-
Dry residue	mg/l	1500	-
Suspended matter	mg/l	+ 0.25 mg/l to background concentrations (household and drinking water) + 0.75 mg/l to background concentrations (recreational water)	-

Parameter	Unit	$MPC_{domestic}$ [a]	$MPC_{fishery}$ [b]
Dissolved oxygen	mg/l	≤ 4	-
COD	mgO/l	15 (household and drinking water) 30 (recreational water)	-
BOD5	mg/l	3.0 (household and drinking water) 6.0 (recreational water)	-
Synthetic surfactants	mg/l	0.5	0.5
Sodium	mg/l	200	120
Aluminium	mg/l	0.5	-
Arsenic	mg/l	0.05	0.05
Cadmium	mg/l	0.001	0.005
Chromium	mg/l	0.5	-
Copper	mg/l	1.0	0.001
Iron	mg/l	0.3	0.1
Nickel	mg/l	0.1	0.01
Lead	mg/l	0.03	-
Zinc	mg/l	5.0	0.05
Mercury	mg/l	0.0005	-
Magnesium	mg/l	-	40
Sulphur Dioxide	mg/l	500	100
Chlorine	mg/l	350	300
Ammonium (NH4)	mg/l	-	0.5
Ammonium ($N-NH_4$)	mg/l	2.0	0.4
Oil/petroleum products	mg/l	0.1	0.05
Napthalene	µg/l	0.01	-

Note:
[a] Maximum Permissible Concentrations for domestic use. These standards control hazardous substance concentrations in water bodies used for household-drinking and utility needs of the population.
[b] Maximum Permissible Concentrations for fishery water bodies. It is the concentration of harmful substances that should not affect the aquatic life and populations of fish.

6.4.3 EARLY-STAGE CONDITIONS

The Project proponent commissioned Poligram LLP to conduct engineering and hydrometeorological surveys to study the natural and anthropogenic hydrometeorological conditions and calculate the hydrological conditions of the Project area[90]. The National EIA conducted visual inspections and secondary data analyses but did not conduct any baseline surveys. ERM visited the Project site from 28 October – 8 November 2024 and conducted a visual and qualitative inspection of the Project affected water bodies, noting that construction works were occurring at several locations.

Information from these studies and site visit has been summarised and presented below to provide an overview of early-stage conditions across the study area. Discussions of how the Project works could potentially impact the river features are included in **Section 6.4.6.2**.

6.4.3.1 PROJECT DRAINAGE BASIN

As reported in the National EIA and hydrometeorological report, the Project is located in the Ili Depression and is erosion-accumulative, gently undulating, and with small hilly elevations. Stable snow cover in the foothills is established in early December and late September to early October in the Ili Alatau mountain range. Annual precipitation ranges from 300mm in the plains to 1,000 mm in the mountains. In the warm period of the year (April to October), 50-75% of the annual precipitation occurs, especially from wet air masses from the Black and Caspian Seas to the West causing heavy rains in the foothills.

All the Project affected rivers feed into the Ili River and Lake Balkhash. The Project hydrographic system is the Lake Balkhash basin and the main aquifer is the Ili River Aquifer. The Ili River spans approximately 1,439 km and flows from the Tian Shan mountains in China into Kazakhstan, ultimately discharging into Lake Balkhash. It is one of the major rivers in the region, with a basin size of approximately 140,000 km^2. The Ili River has a well-developed 5 to 9 km wide flat valley with eroded upper terraces and steep banks. The hydrological regime of the Ili River has been affected by human activities such as water retention for agriculture and dam construction. These interventions have led to significant fluctuations in water supply to both the river and Lake Balkhash, impacting local ecosystems[91]. According to Kazhydromet, the Comprehensive Water Pollution Index (CWPI) for the Ili River has been assigned "Class III[92]" from 2021 to 2023[93]. This system of classification allows for seven (7) different water quality classes[94]. Class III indicates moderately contaminated waters with 1.1-2.5 WPI values.

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[90] Technical Report Based on the Results of Engineering and Hydrometeorological Surveys for the Preparation of Project Documentation 754189/2022/1-Y.3, Poligram, 2023

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[92] United Nations Economic Commission for Europe, & Regional Environmental Centre for Central Asia. (2018). *Surface waters quality monitoring systems in Central Asia: Needs assessment*. Retrieved from https://unece.org/DAM/env/Projects_in_Central_Asia/SURFACE_WATERS_QUALITY_MONITORING_SYSTEMS_IN_CENTRAL_ASIA_NEEDS_ASSESSMENT.pdf

[93] Committee on Statistics of the Republic of Kazakhstan. (n.d.). *Environmental protection in the Republic of Kazakhstan, C-05-Г-2019-2023*. Retrieved from https://stat.gov.kz/upload/iblock/b8a/6zrap7766lq7s7p0ziu241ssug6b31dz/%D0%A1-05-%D0%93-2019-2023%20(%D0%B0%D0%BD%D0%B3%D0%BB).pdf

[94] The seven (7) classes of water classification characterises waters ranges from Class I with 'Very clean waters' and WPI value of 0.3 and less to Class VII with 'Extremely dirty waters' with WPI more than 10.0. The 7-class system considers the cumulative availability of the six (6) pollutants with the largest concentration measured, including dissolved oxygen and BOD.

6.4.3.2 HYDROLOGICAL AND HYDRAULIC OVERVIEW OF PROJECT AFFECTED RIVERS

The locations of Project bridges and culverts are summarised in **Table 6-60** and **Table 6-61** respectively. The Project affected rivers are described in order from west to east of the alignment in the following sections and presented in hydrological maps from **Figure 6-15** to **Figure 6-18**. Further details of these project components were described in **Section 2**. The railway alignment will intersect the Uzyn Kargaly, Zhyngyldy, Zhamankyul, Kaskelen, Malaya Almatinka, and Karasu Baiserke rivers as well as irrigation canals. These mixed and glacial-fed rivers originate from rainfall and melting glaciers and snow from the Zailiyskiy Alatau mountain range, part of the larger Tian Shan Mountain system. These rivers will drain to the Balkhash Basin with floods observed in the summer months. Upstream ponds and small reservoirs are located south of the Project based on the 2023 Hydrometeorological Report[95].

The 2023 Hydrometeorological Report had been carried out by calculating discharges for various return periods, such as 2-year, 4-year, 10-year, 25-year, and 100-year floods. The 100-year return period flood (1% Probability Exceedance flood) has been adopted for the design of the Project bridges, following the guidelines specified in "SME 3.04-101-2005: Determination of the Main Design Hydrological Characteristics". produced maximum water discharge values and flood hydrographs for the Uzyn Kargaly, Kaskelen and Malaya Almatinka Rivers. Volumetric flow data was sourced from Kazhydromet for the years 1932 – 2023 from Hydrological Yearbooks, Annual Indicators on the Regime and Resources of Surface Water (AIS), Main Hydrological Characteristics (MHC), Long-term Data on the Regime and Resources of Surface Water (LDS). Hydrographic characteristics of the basins were determined based on maps at scales of 1:25,000, 1:100,000, and 1:500,000, as well as satellite images from Google Earth Pro and maps from websites such as Retromap[96] and OpenStreetMap[97]. Hydrological and hydraulic calculations were carried out in accordance with NIMP-72 recommendations for accepted calculated water discharges for bridges, MSP 3.04-101-2005 and the "Guidelines for hydraulic calculations of small engineering structures". The calculated maximum discharges are determined in accordance with the requirements of MSP 3.04-101-2005 "Determination of Basic Calculated Hydrological Characteristics". Based on the estimated discharges for the 100-year return period, the bridge design levels were determined. However, the report does not provide detailed calculations or design parameters demonstrating how the discharges were specifically applied to the structural design of all Project bridges. ERM notes that international standard industry practice is for bridges and culverts to be designed to convey a peak flood flow with an estimated 100-year Average Recurrence Interval (Q100). However, it is only mentioned that the 100-year return period discharge has been used for designing the bridges, but the exact methodology or design considerations associated with this discharge were not presented.

Additionally, the 2023 Hydrometeorological Report did not consider climate change scenarios in its calculations. This may potentially reduce the lifespan of the Project infrastructure and cause serviceability issues. However, as the Project bridge designs include additional

95 Technical Report Based on the Results of Engineering and Hydrometeorological Surveys for the Preparation of Project Documentation 754189/2022/1-Y.3, Poligram, 2023
96 http://retromap.ru/
97 https://www.openstreetmap.org/

freeboard, the risk of such an impact may be minimal. Further details are included in the sections below.

FIGURE 6-15: HYDROLOGICAL MAP OF THE PROJECT AREA (1)

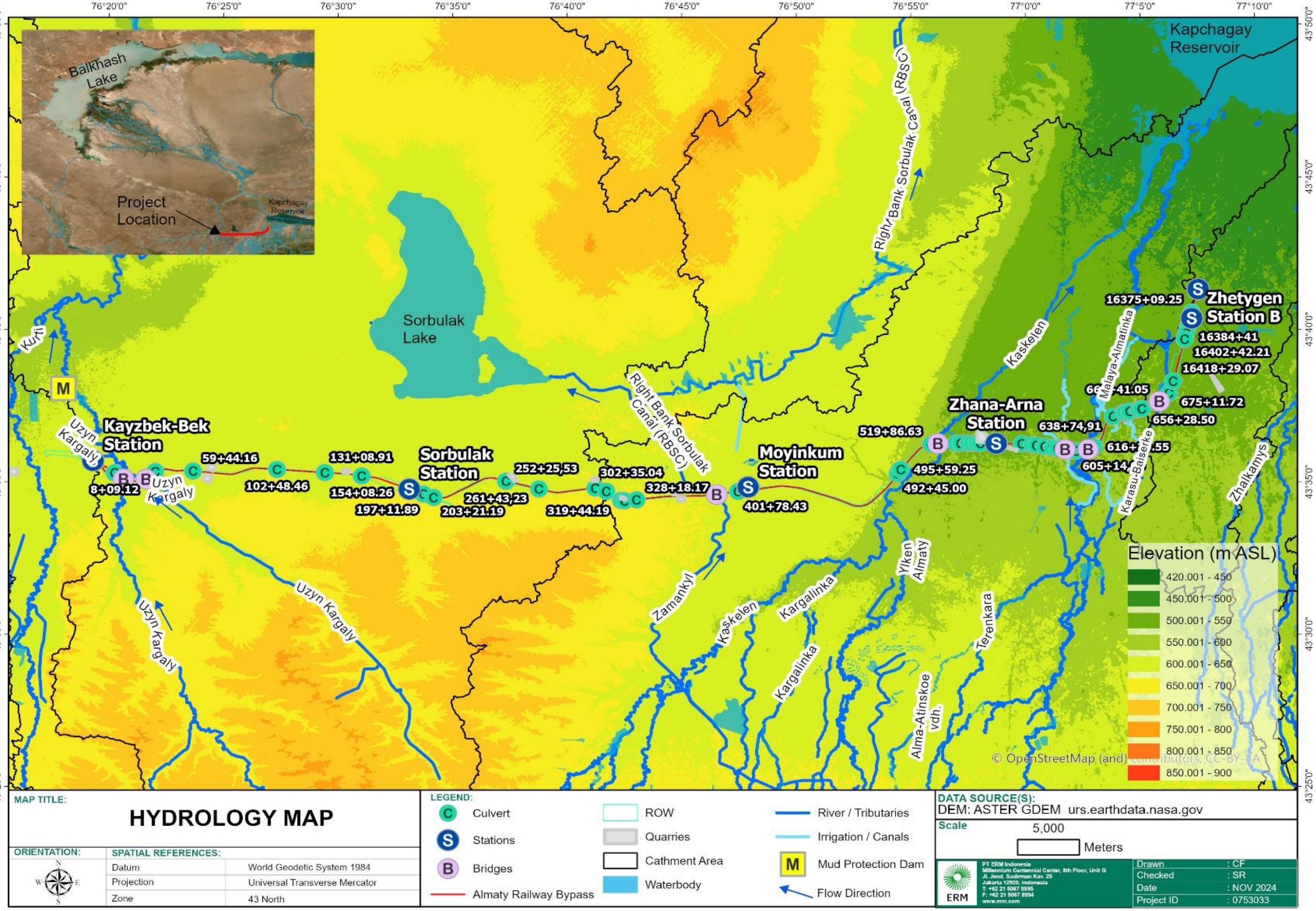


FIGURE 6-16: HYDROLOGICAL MAP OF THE PROJECT AREA (2)

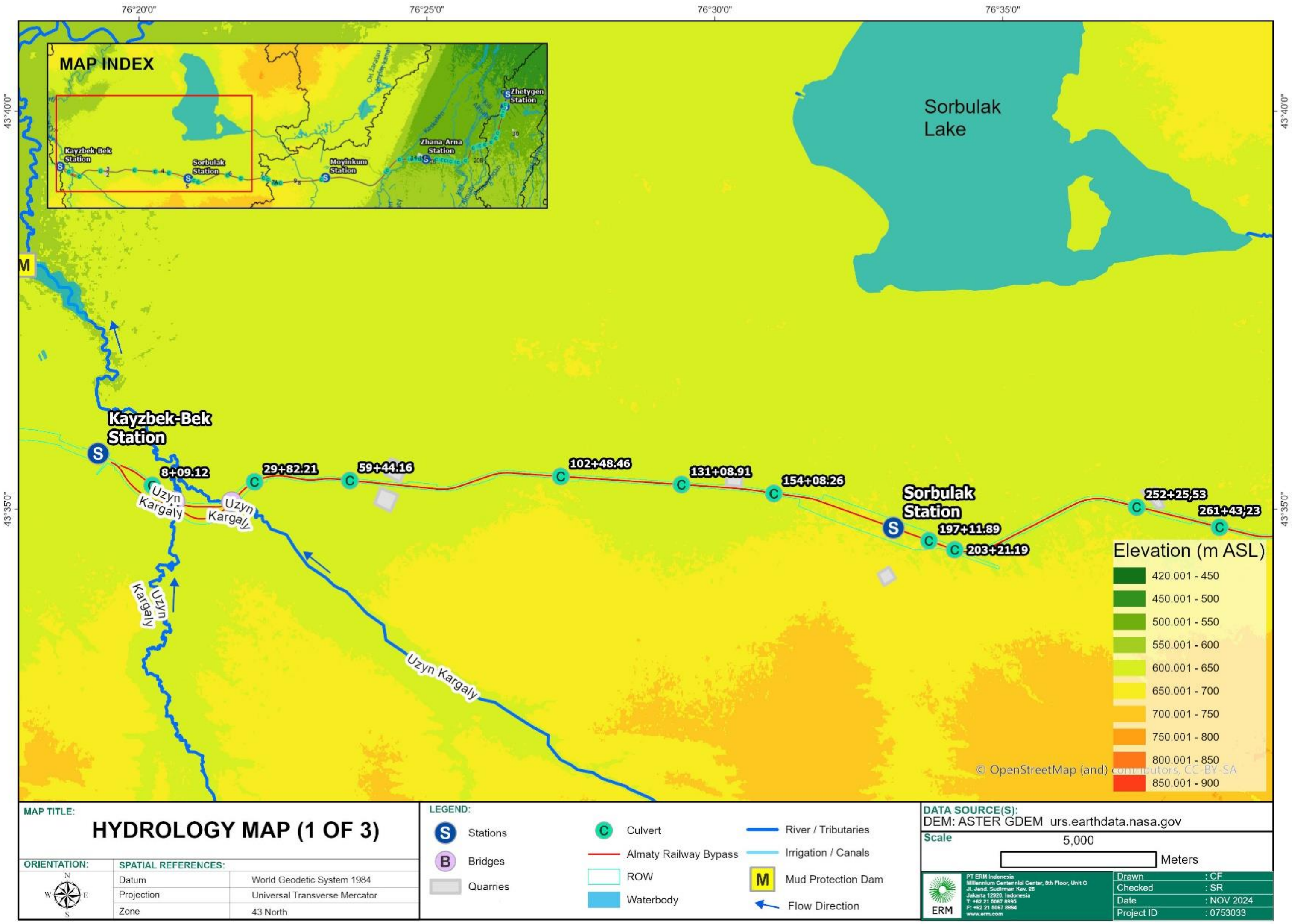


FIGURE 6-17: HYDROLOGICAL MAP OF THE PROJECT AREA (3)

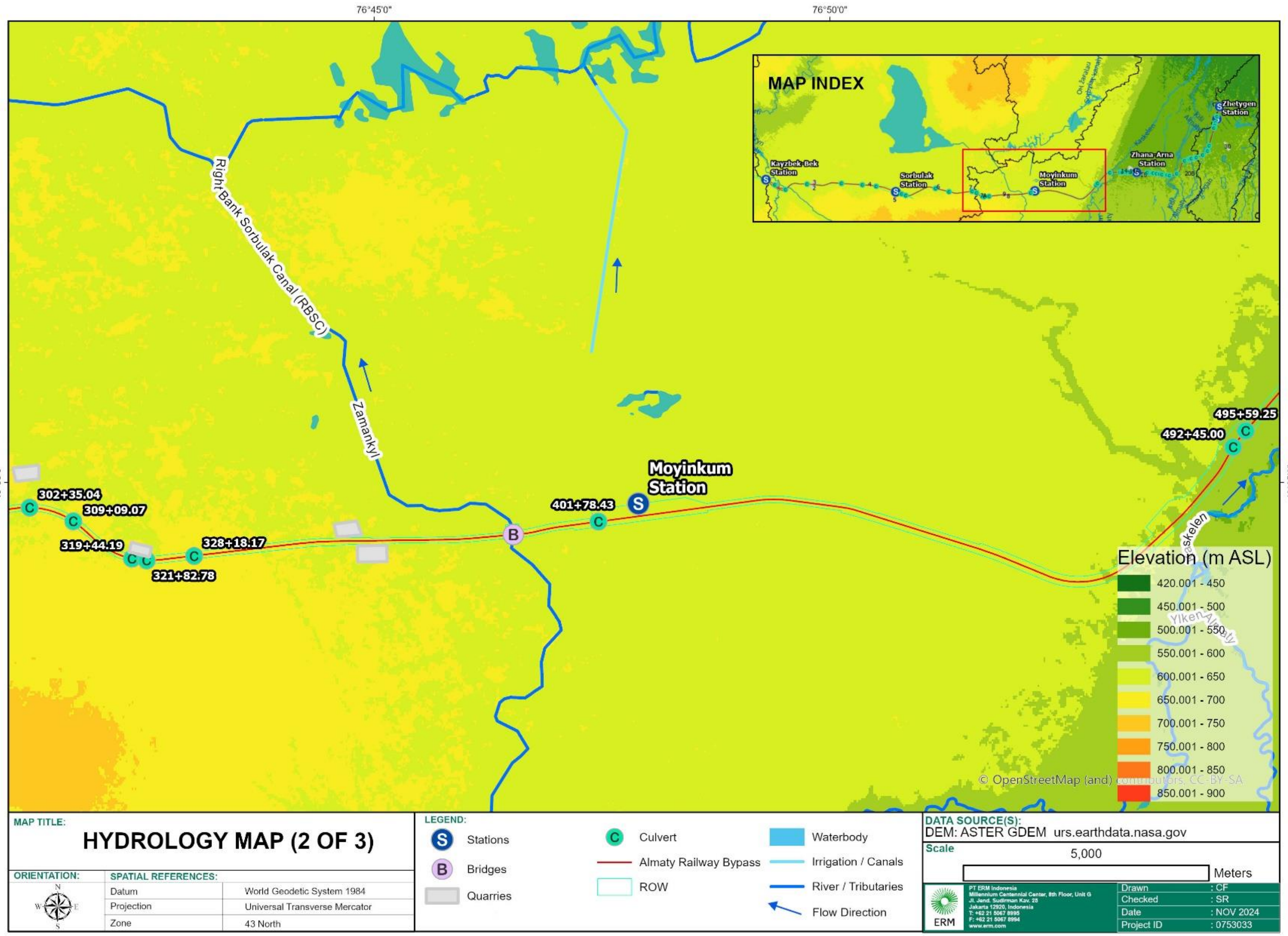
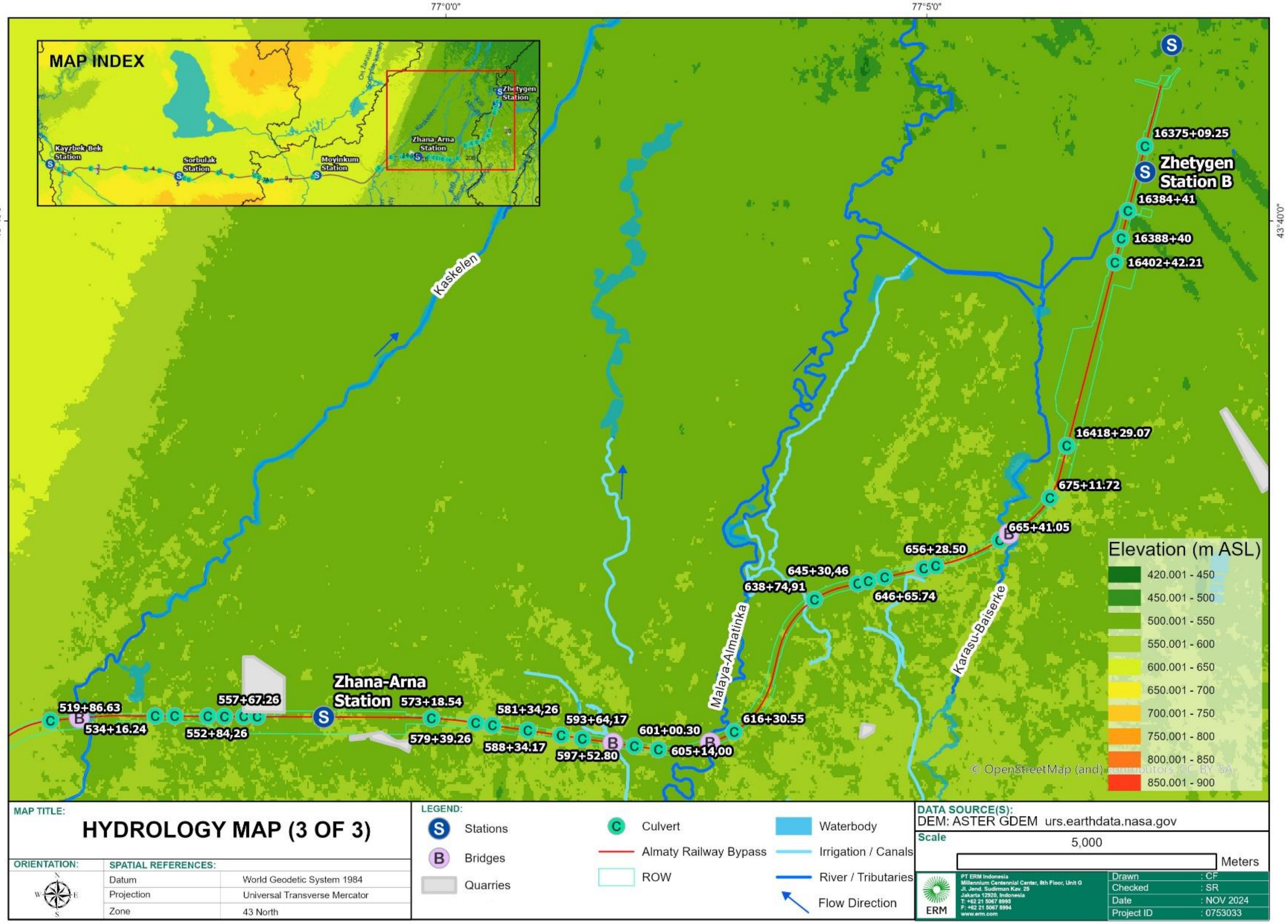


FIGURE 6-18: HYDROLOGICAL MAP OF THE PROJECT AREA (4)



Uzyn Kargaly River

From Kazybek Bek Station, two axes of the railway line will travel east and intersect the Uzyn Kargaly River. The intersections of the Project with the river at two metal bridges PK 16+03.14 and PK 17.69.07 are an estimated 27km away from the river source. The 87km perennial river has a mixed glacial, snow and rain melt source with a peak discharge in the spring to summer months. There is an existing mudflow protection dam that limits the peak flow in the lower sections of the river 6.5km northwest of the Project intersection with the river[98]. There is also an existing railway bridge over the river with a length of 30m, part of the existing Almaty-Otar railway line, approximately 25m southwest of the railway bridge at PK 16+38.82[99].

The river is used for supporting agricultural irrigation for crops and livestock in the surrounding areas. Increased water abstraction for agricultural and urban needs can lead to reduced flow levels, which is reported to result in both ecological impacts and reduced water availability[100].

In the 2023 Hydrometeorological Report the 100-year return period flood (1% Probability Exceedance flood) has been adopted for the design of the railway bridge at PK 16+03.14 over the Uzyn Kargaly River. The discharge at the observed gauge location (approximately 60 km upstream of the railway alignment) is 30.54 m^3/s for 100-year return period, whereas the discharge at the bridge site was calculated to be 33.43 m^3/s. This estimation was made based on analogy with the functional dependence of the discharge at the mouth of the Kaskelen River. Based on the estimated discharge of 33.43 m^3/s for the 100-year return period, the bridge design levels have been determined. However, the report does not provide detailed calculations or design parameters demonstrating how this discharge was specifically applied to the structural design of all Project bridges.

The hydrological calculations were conducted for the first bridge intersecting the Uzyn Kargaly River at PK 16+03.14 but not conducted for the second bridge at PK 17+69.07. Since the second bridge at PK 17+69.07 is located upstream from the first, the design discharge is expected to be similar. Although there may be slight differences in water levels based on the cross-section, these details were not provided in the report. The absence of specific information about the potential variation in levels between the two bridges leaves a gap in the hydraulic analysis. There is potential for increased turbidity and sediment loads in watercourses to occur because of river channel and bank erosion if cross-drainage infrastructure is inadequately designed.

Zhyngyldy River

Based on National EIA, the two axes of the railway line will converge and cross the Zhyngyldy River. The alignment will have a culvert through the embankment and under the track line to continue the flow of the Zhyngyldy River at PK 29+82.21. The river is a tributary of the Uzyn

98 Poligram. (2023). *Technical report based on the results of engineering and hydrometeorological surveys for the preparation of project documentation 754189/2022/1-Y.3*.
99 IP “InTech”. (2023). Environmental Impact Assessment (EIA)
100 Chigrinets, A. G., Mazur, L. P., Duskayev, K. K., Chigrinets, L. Y., & Akhmetova, S. T. (2019). *Water economy balance of the Almaty city*. *Journal of Ecological Engineering*, 20(3), 194–203. https://doi.org/10.12911/22998993/99783

Kargaly River and drains into the Kaskelen River basin. The Zhyngyldy River, classified[101] as "group II[102]" and "subgroup a[103]" is characterised by low flow during the dry season and spring-summer floods primarily resulting from snowmelt and rainfall. Zhyngyldy River relies on slope runoff and groundwater from the developed areas for its water supply. Data on the long-term average runoff, recorded at 4.1mm, come from limited observations (1962-1964), making them insufficient for long-term hydrological calculations. Additionally, no information on the river's flow is available in publicly available literature or from Kazhydromet. As part of the project, maximum runoff values for rainfall floods were calculated for the first time using a reduction formula in the 2023 Hydrometeorological Report[104]. This provided an alternative catchment runoff approach for this ungauged river with adoption of precipitation data based on Trans-Ili Alatau region for the catchment.

The river is primarily used for agricultural irrigation for crops and livestock. The river merges with the Uzyn Kargaly River 1.5km northwest of the Project intersection with the river and its existing mudflow protection dam downstream (see **Figure 6-15**). The downstream dam can present a flow barrier during peak flow periods to improve flow capacity control from potential sediment load as a result of Project culvert construction activities. Increased water abstraction for agricultural and urban needs can lead to reduced flow levels, impacting both ecological health and water availability (Chigrinets, 2019).

The 2023 Hydrometeorological Report[105] had been carried out as mentioned above with the 100-year return period flood (1% Probability Exceedance flood) adopted for the design of the railway bridge at PK 29+82.21. As mentioned above, the exact methodology or design considerations associated with the 100-year return period discharge were not presented.

Zhamankyul River

The Project intersects the Zhamankyul River at a metal bridge at PK377+29.65. The Zhamankyul River is a tributary of the Right Bank Sorbulak Canal (RBSC) that ultimately feeds into the Sorbulak Lake. The Zhamankyul River is a key dilution inflow into the RBSC and Sorbulak Lake. There are no other publicly available information and document references related to the Zhamankyul River, however there is available information on the RBSC. The RBSC was constructed to manage the discharge of biologically treated wastewater into the Sorbulak storage lake and to prevent overflow from this reservoir. It allows for controlled release of treated effluent into a system of shallow ponds and ultimately into the Ili River. The RBSC and Sorbulak Lake are part of the KBA and IBA Sorbulak Lake System as detailed in **Section 2.1.3**.

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[101] According to the classification of Zaikov B.D., Average stock and its distribution in the year on the territory of the USSR.

[102] Includes rivers in the mountainous regions with sharp fluctuations in height to catchments exceeding 400m, which cause uneven snowmelt in different altitudinal zones and, consequently, uneven water inflow from different parts of the catchment area into the channel.

[103] Includes rivers with spring-summer floods, formed mainly due to the melting of seasonal snows, perennial snowfields and rainfall.

[104] Technical Report Based on the Results of Engineering and Hydrometeorological Surveys for the Preparation of Project Documentation 754189/2022/1-Y.3, Poligram, 2023

[105] Technical Report Based on the Results of Engineering and Hydrometeorological Surveys for the Preparation of Project Documentation 754189/2022/1-Y.3, Poligram, 2023

The 2023 Hydrometeorological Report[106] had been carried out as mentioned above with the 100-year return period flood (1% Probability Exceedance flood) adopted for the design of the railway bridges. As mentioned above, the exact methodology or design considerations associated with the 100-year return period discharge were not presented.

Kaskelen River

The Project crosses the Kaskelen River and will construct a metal bridge at PK 525+55.87. Findings from the National EIA and the 2023 Hydrometeorological Report[107] indicate the Kaskelen River originates from glacier and snowmelt from the Ili Alatau Mountain range. It flows through the Karasai and Ili districts before emptying into the Kapchagay Reservoir. The river has a well-developed hydrographic network as well as several karasu (groundwater rich in minerals) springs. The area of the Kaskelen River Basin is reduced to 2,692km² and the river length is 150km, with an average watershed elevation of 1,512m. Annual water flow is relatively stable, increasing during the spring melting season. The long-term average discharge is recorded at 4.4 m³/s, with a maximum flow of 15.0-16.0 m³/s in July and a minimum flow of 0.2-3.8 m³/s occurring between December and March. According to Kazhydromet, the Comprehensive Water Pollution Index (CWPI) for the Kaskelen River has been assigned "Grade 2[108]" in 2023[109].

In the National EIA, according to N.F. Kolotilin's classification, the Kaskelen River basin is categorized as Category II[110] - Declining Mudflow Activity. To protect local areas from mudflows, sediment-retaining structures have been established along its tributaries. While the upper part of the Kaskelen River basin remains in a natural state, the lower part has been modified due to economic activities. Its water is utilised for domestic supply and irrigation in Almaty, Kaskelen, and suburban areas. The river empties into the Kapchagay Reservoir that is also used for agricultural irrigation as well as powers the Kapchagay hydroelectric power station that generates electricity for the surrounding areas. The reservoir is used for recreational activities such as swimming, wakeboarding and fishing[111]. Fish species such as bream, carp, perch, asp, catfish, etc. have been recorded in the reservoir[112].

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[106] Technical Report Based on the Results of Engineering and Hydrometeorological Surveys for the Preparation of Project Documentation 754189/2022/1-Y.3, Poligram, 2023
[107] Technical Report Based on the Results of Engineering and Hydrometeorological Surveys for the Preparation of Project Documentation 754189/2022/1-Y.3, Poligram, 2023
[108] Grade 2 indicates very clean waters with 0.31-1.0 WPI values.
United Nations Economic Commission for Europe, & Regional Environmental Centre for Central Asia. (2018). Surface waters quality monitoring systems in Central Asia: Needs assessment. Retrieved from https://unece.org/DAM/env/Projects_in_Central_Asia/SURFACE_WATERS_QUALITY_MONITORING_SYSTEMS_IN_CENTRAL_ASIA_NEEDS_ASSESSMENT.pdf
[109] Committee on Statistics of the Republic of Kazakhstan. (n.d.). Environmental protection in the Republic of Kazakhstan, С-05-Г-2019-2023. Retrieved from https://stat.gov.kz/upload/iblock/b8a/6zrap7766lq7s7p0ziu241ssug6b31dz/%D0%A1-05-%D0%93-2019-2023%20(%D0%B0%D0%BD%D0%B3%D0%BB).pdf
[110] Basins classified under Category II exhibit a decreasing trend in mudflow activity. While mudflows can still occur, the frequency and intensity are lower compared to Category I.
[111] Editorial Team of the Historical Media Project Qalam. (2024, June 23). Discover Kazakhstan: "Almaty Sea." Why Lake Qapshagai is so beloved? The Astana Times. Retrieved from https://astanatimes.com/2024/06/discover-kazakhstan-almaty-sea-why-lake-qapshagai-is-so-beloved/
[112] Mukhatzhanova, Z. (30 March 2023). Kapchagai Reservoir. Welcome.kz. Retrieved from https://welcome.kz/en/info-cities/almaty-region/kapchagay-reservoir

The 2023 Hydrometeorological Report[113] has been carried out as mentioned above with the 100-year return period flood (1% Probability Exceedance flood) adopted for the design of the railway bridge. As mentioned above, the exact methodology or design considerations associated with the 100-year return period discharge were not presented.

Unnamed irrigation drain

There is a traditional irrigation ditch, called aryks, fed by the Malaya Almatinka River upstream. These irrigation systems historically ensured water flow through cities to support agriculture. Construction of dams on major rivers to supply irrigation water provided a relatively more reliable water source to feeder channels leading to irrigation canals[114]. The Project will intersect this drain at PK598+77.00 and construct a reinforced concrete bridge (cattle bridge).

Malaya-Almatinka River

The Project will intersect the Malaya-Almatinka River at a metal bridge at PK 614+20.29. Findings from the National EIA and the 2023 Hydrometeorological Report indicate the Malaya Almatinka River originates at an altitude of 3,200m sourced from a group of glaciers, the largest being the Tuyuksu Glacier. It features approximately 20 tributaries, primarily within mountainous regions. The catchment area at the river's exit from the mountains is 118km², expanding to 710km² at its mergence with the Kapshagay Reservoir. The Karasu-Baiserke River is a tributary in addition to smaller streams and karasu springs. The National EIA stated that there is an existing dam and reservoir downstream that regulates water flow 2.1km north of the Malaya-Almatinka River. According to Kazhydromet, the Comprehensive Water Pollution Index (CWPI) for the Malaya Almatinka River has been assigned “Grade 3[115]” in 2023[116].

The Malaya Almatinka River flows into the Kaskelen River before discharging into the Kapshagay Reservoir. Similar to the Kaskelen River, the Malaya Almatinka River is mostly used for agriculture irrigation for crops and livestock. There has been further urban development towards the Kapshagay Reservoir which has impacted the river’s flow regulation and water consumption. The riverbed is composed of sandy loam and pebbles and the surrounding vegetation comprise of wormwood and bushes.

The 2023 Hydrometeorological Report[117] had been carried out as mentioned above with the 100-year return period flood (1% Probability Exceedance flood) adopted for the design of the

[113] Technical Report Based on the Results of Engineering and Hydrometeorological Surveys for the Preparation of Project Documentation 754189/2022/1-Y.3, Poligram, 2023
[114] Pueppke, S. G., Zhang, Q., & Nurtazin, S. T. (2018). Irrigation in the Ili River Basin of Central Asia: From ditches to dams and diversion. Water, 10(11), 1650. https://doi.org/10.3390/w10111650
[115] Grade 3 indicates moderately contaminated waters with 1.1-2.5 WPI values.
United Nations Economic Commission for Europe, & Regional Environmental Centre for Central Asia. (2018). Surface waters quality monitoring systems in Central Asia: Needs assessment. Retrieved from https://unece.org/DAM/env/Projects_in_Central_Asia/SURFACE_WATERS_QUALITY_MONITORING_SYSTEMS_IN_CENTRAL_ASIA_NEEDS_ASSESSMENT.pdf
[116] Committee on Statistics of the Republic of Kazakhstan. (n.d.). Environmental protection in the Republic of Kazakhstan, С-05-Г-2019-2023. Retrieved from https://stat.gov.kz/upload/iblock/b8a/6zrap7766lq7s7p0ziu241ssug6b31dz/%D0%A1-05-%D0%93-2019-2023%20(%D0%B0%D0%BD%D0%B3%D0%BB).pdf
[117] Technical Report Based on the Results of Engineering and Hydrometeorological Surveys for the Preparation of Project Documentation 754189/2022/1-Y.3, Poligram, 2023

railway bridge. As mentioned above, the exact methodology or design considerations associated with the 100-year return period discharge were not presented.

Karasu-Baiserke River

The Project will intersect the Karasu-Baiserke River at a metal bridge at PK 669+18.59. The 2023 Hydrometeorological report mentions that the Karasu-Baiserke River is primarily fed by "karasu" groundwater springs, snowmelt and rainwater, classifying it as a river with spring-summer floods. The river's flow is from tributaries which flow in from the right side of the Talgar River basin. The river benefits from underground runoff from the Talgar River basin. The river mouth is located in a steppe habitat and has a catchment area with a gently sloping plain that flows into the Kaskelen River. Upstream of the river, the National EIA stated that the river flow is regulated by numerous small dams upstream. Downstream of the railway crossing, the river is blocked by a major dam. Below the village of Baiserke, the river branches into a system of aryks that irrigate fields south of Zhetygen. The National EIA stated that more than 50% of structures along the river are irrigation ditches and canals. The section of the river that intersects with the Project remains mostly dry and without runoff, with runoff occurring during heavy rainfall and snowmelt.

The 2023 Hydrometeorological Report[118] had been carried out as mentioned above with the 100-year return period flood (1% Probability Exceedance flood) adopted for the design of the railway bridge. As mentioned above, the exact methodology or design considerations associated with the 100-year return period discharge were not presented.

6.4.3.3 SITE VISIT OBSERVATIONS

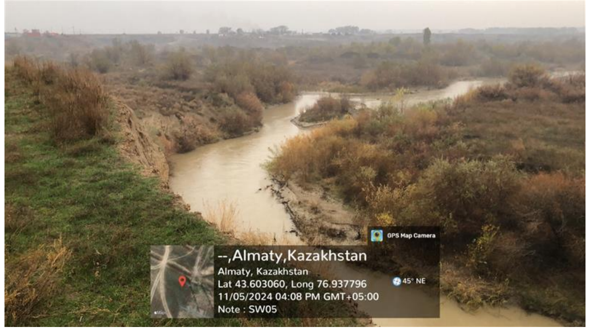
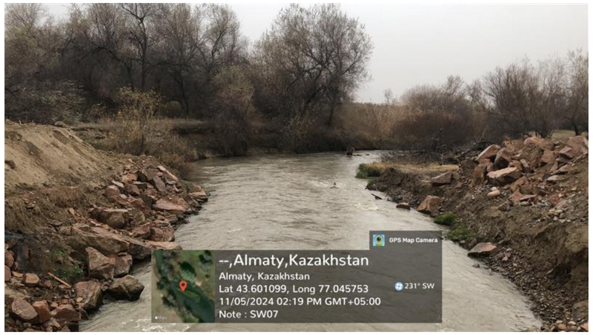
Observations from the site visit are summarised in **Table 6-59**. The site visit was conducted from 28 October – 8 November 2024. There was rainfall on 28 October 2024, two (2) days before ERM’s site visit to the Uzyn Kargaly and Zhyngyldy Rivers on 30 October 2024. There was snowfall on 7 November 2024, in the early morning on the same day of ERM’s site visit to the Zhamankyul River. No other rain or snowfall event occurred in the days preceding each waterway visit.

[118] Technical Report Based on the Results of Engineering and Hydrometeorological Surveys for the Preparation of Project Documentation 754189/2022/1-Y.3, Poligram, 2023

TABLE 6-59: WATERWAYS VISUAL OBSERVATIONS

Waterway	Photographs	Construction Occurring	Key Findings
Uzyn Kargaly River (SW01/02)	Downstream of the Project bridge:  Upstream of the Project bridge: 	Yes Temporary road installed over river for construction that will be removed post-construction. Drainage pipes installed to maintain flow.	• Suspended sediment observed. • No other visible pollution (foam, oil, algae, litter) observed. • No biodiversity observed.

Waterway	Photographs	Construction Occurring	Key Findings
Zhyngyldy River (SW03)	Downstream of the Project culvert: 	Yes Railway track with embankment constructed over the river. Culvert installed to maintain flow. Temporary road installed over river for construction and will be removed post-construction. Drainage pipes installed to maintain flow.	• No visible flow due to the dry season. • No other visible pollution (foam, oil, algae, litter) observed. • No biodiversity observed.
Zhamankyul River (SW04)	Upstream of the Project bridge: 	No Scheduled to start December 2024	• Slightly turbid. • No other visible pollution (foam, oil, algae, litter) observed. • Birds including ducks observed. • Cattle farming and army dog training nearby.
Kaskelen River (SW05)	Upstream of the Project bridge:	Yes Temporary road installed over river for construction and will be removed post-construction. Drainage pipes installed to maintain flow.	• Suspended sediment observed. Slightly turbid. • No other visible pollution (foam, oil, algae, litter) observed. • No biodiversity observed.

Waterway	Photographs	Construction Occurring	Key Findings
			
Malaya Almatinka River (SW07)	Downstream of the Project bridge: 	Yes Temporary road installed over river for construction and will be removed post-construction. Drainage pipes installed to maintain flow.	• Slightly turbid. • Some algae on rocks with plants growing on riverbanks • No other visible pollution (foam, oil, litter) observed. • No biodiversity observed. • Surrounding areas are crop cultivation and agriculture • Stones placed on riverbanks as an erosion control measure
Karasu Baiserke River (SW10)	Upstream of the Project bridge: 	Yes Temporary road installed over river for construction and will be removed post-construction. Drainage pipes installed to maintain flow.	• Slightly turbid. • No other visible pollution (foam, oil, algae, litter) observed. • Birds and aquatic insects observed

6.4.4 POTENTIAL SOURCES OF IMPACT

The bypass will intersect five (5) rivers as summarised in **Table 6-60**.

In addition, a total of 48 culverts are expected to be required for canals and temporary watercourses and for 'balancing' water levels across the railway embankment in areas such as floodplains are summarised in **Table 6-61**.

TABLE 6-60: PROJECT BRIDGES INTERSECTING RIVERS

No.	Location, PK+	Name of river	Project infrastructure description
Kazybek Bek Station			
1. 1	16+03.14	Uzyn Kargaly River	Metal bridge 80m in length along the Project railway axis I
2. 2	17+69.07	Uzyn Kargaly River	Metal bridge 80m in length along the Project railway axis II
Alignment between Sorbulak and Moyinkum stations			
3. 3	377+29.65	Zhamankyul River	Metal bridge 65m in length
Alignment between Moyinkum and Zhana Arna stations			
4. 4	525+55.87	Kaskelen River	Metal bridge 95m in length
Alignment between Zhana Arna and Zhetygen Stations			
5. 5	598+77.00	Irrigation canal	Reinforced concrete bridge (cattle overpass)
6. 6	614+20.29	Malaya-Almatinka River	Metal bridge 92m in length
7. 7	669+18.59	Karasu-Baiserke River	Metal bridge 92m in length

TABLE 6-61: PROJECT CULVERTS INTERSECTING WATERCOURSES

No.	Location, PK+	Name of watercourse	Project infrastructure description
Kazybek Bek Station			
8. 1	8+09.12	Temporary watercourse	Culvert 15 m in length
9. 2	29+82.21	Zhyngyldy River	Culvert 94 m in length
Alignment between Kazybek Bek and Sorbulak stations			
10. 3	59+44.16	Temporary watercourse	Culvert 10 m in length
11. 4	102+48.46		Culvert 12 m in length
12. 5	131+08.91		Culvert 12 m in length
13. 6	154+08.26		Culvert 12 m in length
Sorbulak station			
14. 7	197+11.89	Irrigation canal	Culvert 14 m in length
Alignment between Sorbulak and Moyinkum stations			
15. 8	203+21.19	Irrigation canal	Culvert 14 m in length

No.	Location, PK+	Name of watercourse	Project infrastructure description
16. 9	252+25,53	Temporary watercourse	Culvert 11 m in length
17. 10	261+43,23		Culvert 14 m in length
18. 11	302+35.04		Culvert 14 m in length
19. 12	309+09.07		Culvert 14 m in length
20. 13	319+44.19		Culvert 17 m in length
21. 14	321+82.78		Culvert 12 m in length
22. 15	328+18.17		Culvert 15 m in length
Moyinkum Station			
23. 16	401+78.43	Temporary watercourse	Culvert 25 m in length
Alignment between Moyinkum and Zhana Arna stations			
24. 17	492+45.00	Ravine	Culvert 78 m in length
25. 18	495+59.25		Culvert 47 m in length
26. 19	519+86.63	Temporary watercourse	Culvert 18 m in length
27. 20	534+16.24		Culvert 11 m in length
28. 21	536+81.62		Culvert 14 m in length
Zhana Arna Station			
29. 22	548+39.26	Temporary watercourse	Culvert 13 m in length
30. 23	552+84,26		Culvert 31 m in length
31. 24	557+67.26	Irrigation canal	Culvert 30 m in length
32. 25	559+54,26		Culvert 30 m in length
Alignment between Zhana Arna and Zhetygen Stations			
33. 26	573+18.54	Main irrigation canal	Culvert 23 m in length
34. 27	579+39.26	Irrigation canal	Culvert 36 m in length
35. 28	581+34,26	Temporary watercourse	Culvert 40 m in length
36. 29	588+34.17	Irrigation canal	Culvert 42 m in length
37. 30	593+64,17		Culvert 27 m in length
38. 31	597+52.80	Main irrigation canal Baykan	Culvert 26 m in length
39. 32	601+00.30	Zhana Arna main canal	Culvert 42 m in length
40. 33	605+14,00	Internal canal R-1 from MK Zhana Arna	Culvert 44 m in length
41. 34	616+30.55	Temporary watercourse	Culvert 32 m in length
42. 35	638+74,91	Main irrigation canal	Culvert 76 m in length

No.	Location, PK+	Name of watercourse	Project infrastructure description
43. 36	645+30,46	Internal canal R-5	Culvert 41 m in length
44. 37	646+65.74	Irrigation canal	Culvert 30 m in length
45. 37	648+78.40		Culvert 23 m in length
46. 38	653+04.74	Internal canal R-2, reinforced concrete channel from BSR 'Kyzyltu'	Culvert 17 m in length
47. 39	653+31	Transfer Canal of BSR 'Kyzyltu' - pond"	Culvert 48 m in length
48. 40	656+28.50	Internal Canal R-1 from BSR 'Kyzyltu'	Culvert 12 m in length
49. 41	665+41.05	Irrigation canal	Culvert 12 m in length
50. 42	675+11.72	Temporary watercourse	Culvert 12 m in length
Zhetygen Station			
51. 43	16375+09.25	Temporary watercourse	Culvert 42 m in length
52. 44	16384+41	Main Canal 'Yntymak-Teris' (Nikolaevsky Canal)	Culvert 66 m in length
53. 45	16388+40	Temporary watercourse	Culvert 63 m in length
54. 46	16402+42.21		Culvert 7 m in length
55. 47	16418+29.07		Culvert 16 m in length

As shown in **Table 6-60** and **Table 6-61** the indicative engineering design[119] of bridges crossing the Uzyn Kargaly, Zhamankyul, Kaskelen, Malaya-Almatinka and Karasu-Baiserke Rivers includes widely spaced piers such that installation of piers in the channel is avoided. During ERM's site visit from 28 October to 8 November 2024, the KTZ site team provided verbal confirmation on the above.

Figure 6-19 to **Figure 6-24** display the engineering designs for various bridges and culverts along

An example of the indicative engineering design of a culvert at Zhyngyldy River is presented in **Figure 6-24**. The culverts are constructed from prefabricated reinforced concrete with waterproofing.

[119] Technical Report Based on the Results of Engineering and Hydrometeorological Surveys for the Preparation of Project Documentation 754189/2022/1-Y.3, Poligram, 2023

FIGURE 6-19: ENGINEERING DESIGN FOR TWO PROJECT BRIDGES OVER THE UZYN KARGALY RIVER

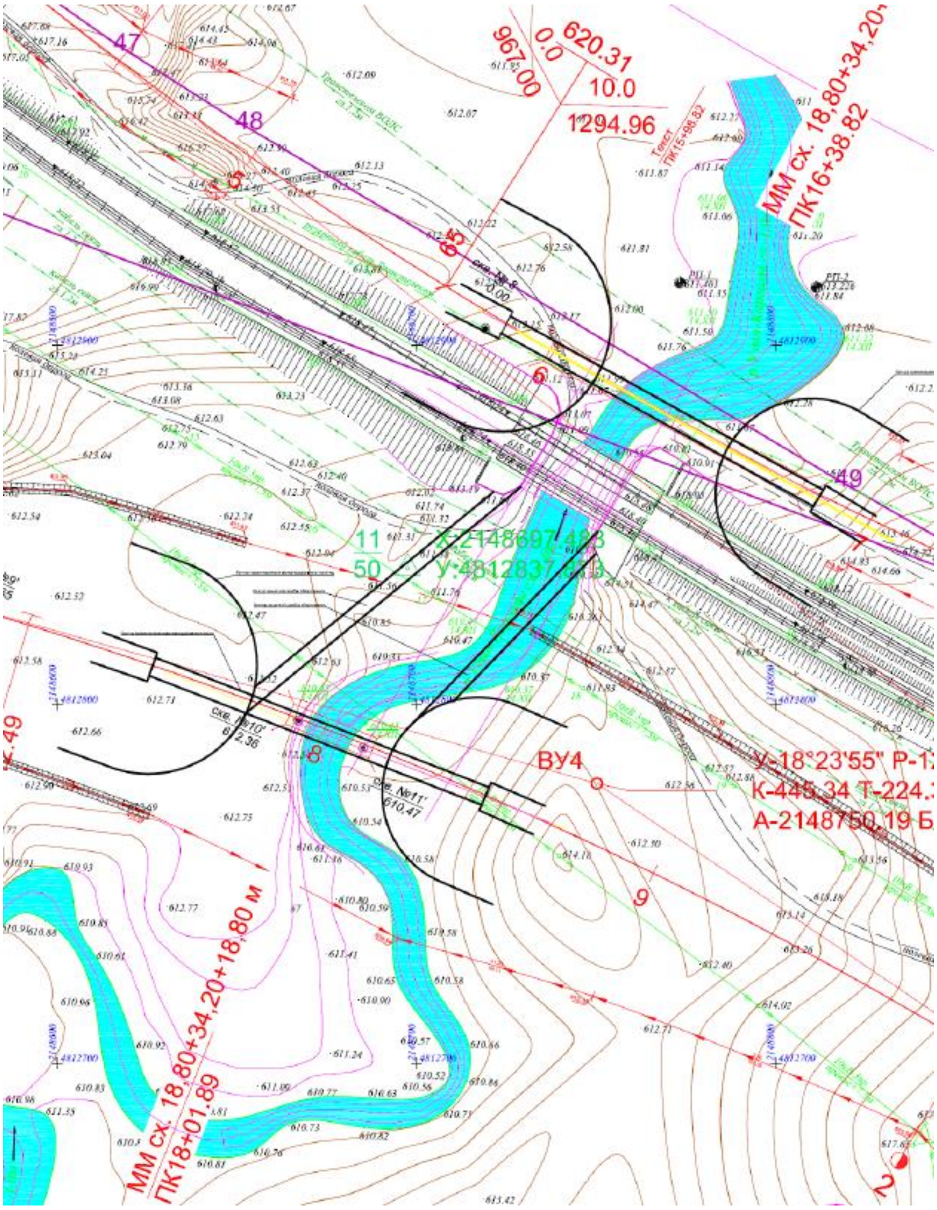


FIGURE 6-20: ENGINEERING DESIGN FOR PROJECT BRIDGE OVER THE ZHAMANKYUL RIVER

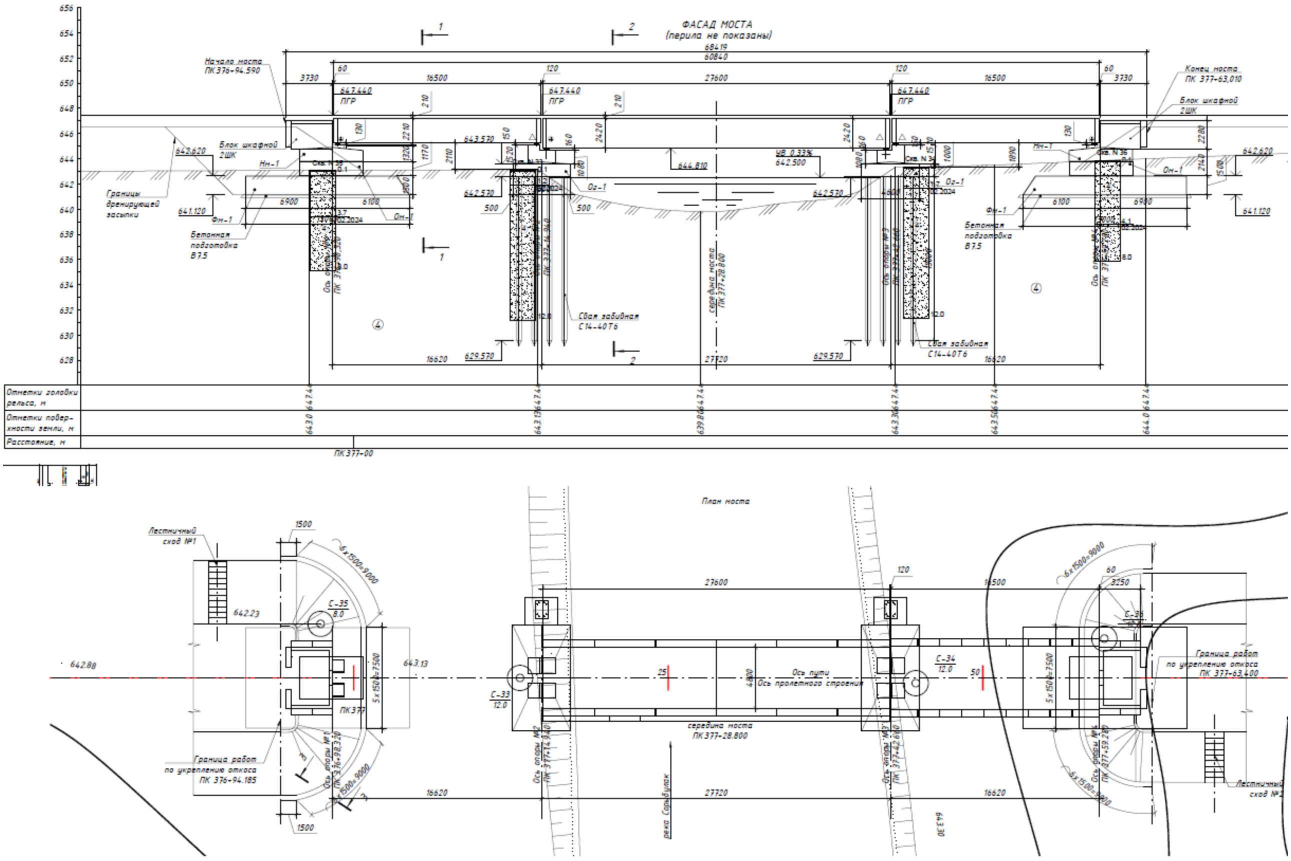


FIGURE 6-21: ENGINEERING DESIGN FOR PROJECT BRIDGE OVER THE KASKELEN RIVER

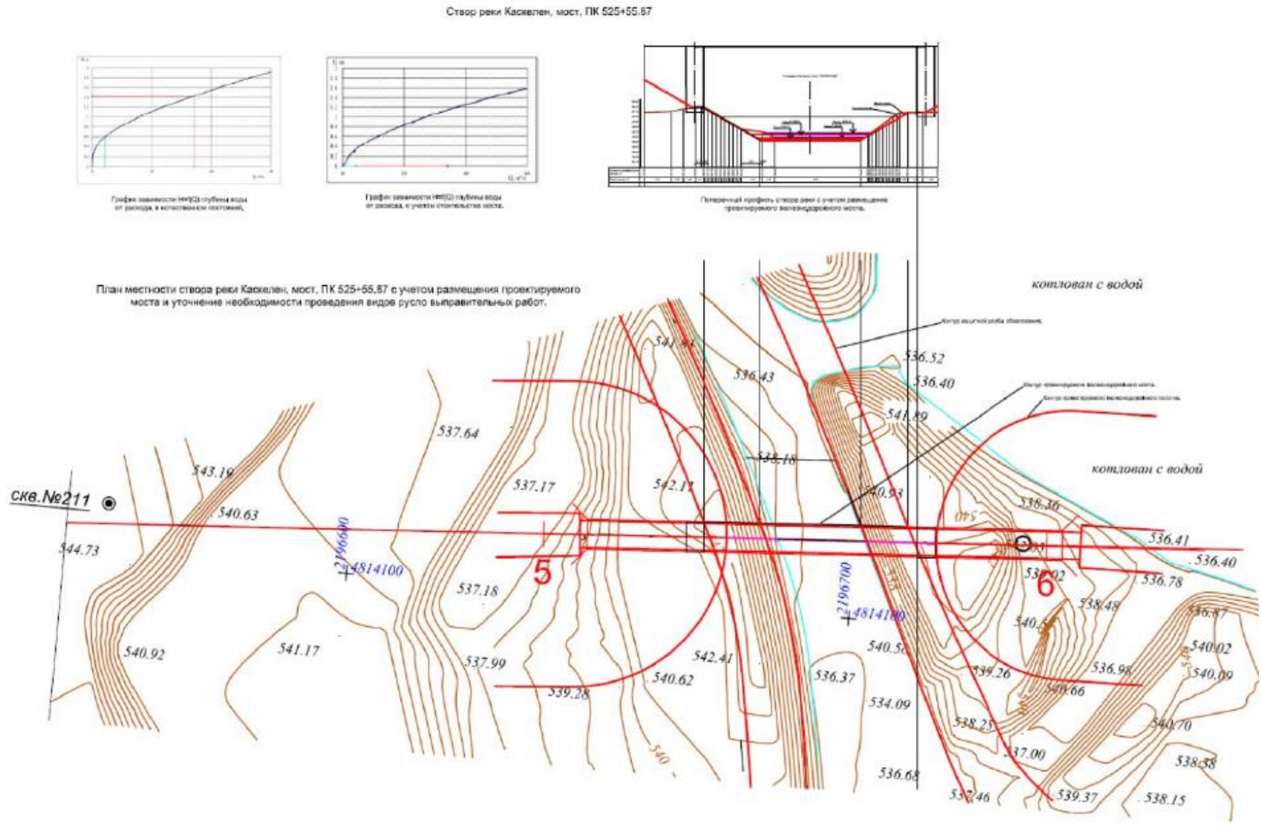


FIGURE 6-22: ENGINEERING DESIGN FOR PROJECT BRIDGE OVER THE MALAYA ALMATINKA RIVER

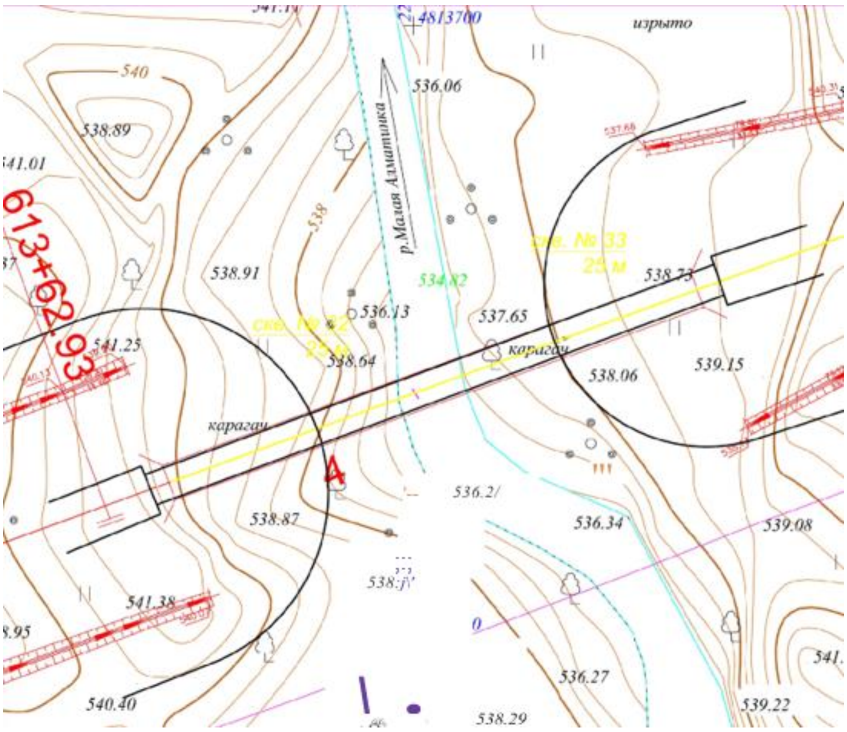


FIGURE 6-23: ENGINEERING DESIGN FOR PROJECT BRIDGE OVER THE KARASU BAISERKE RIVER

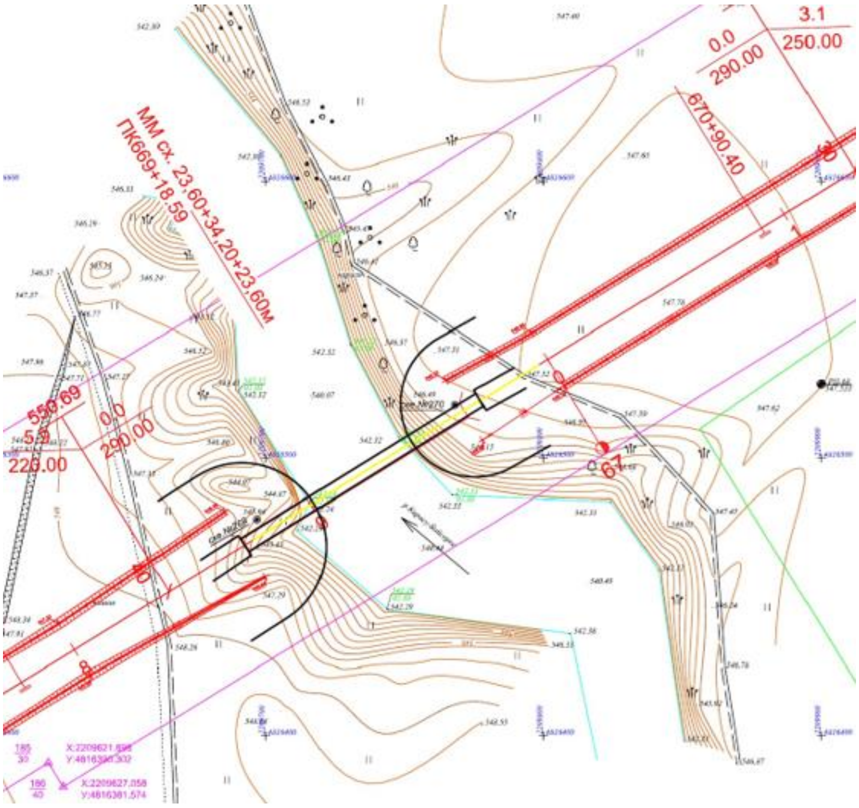
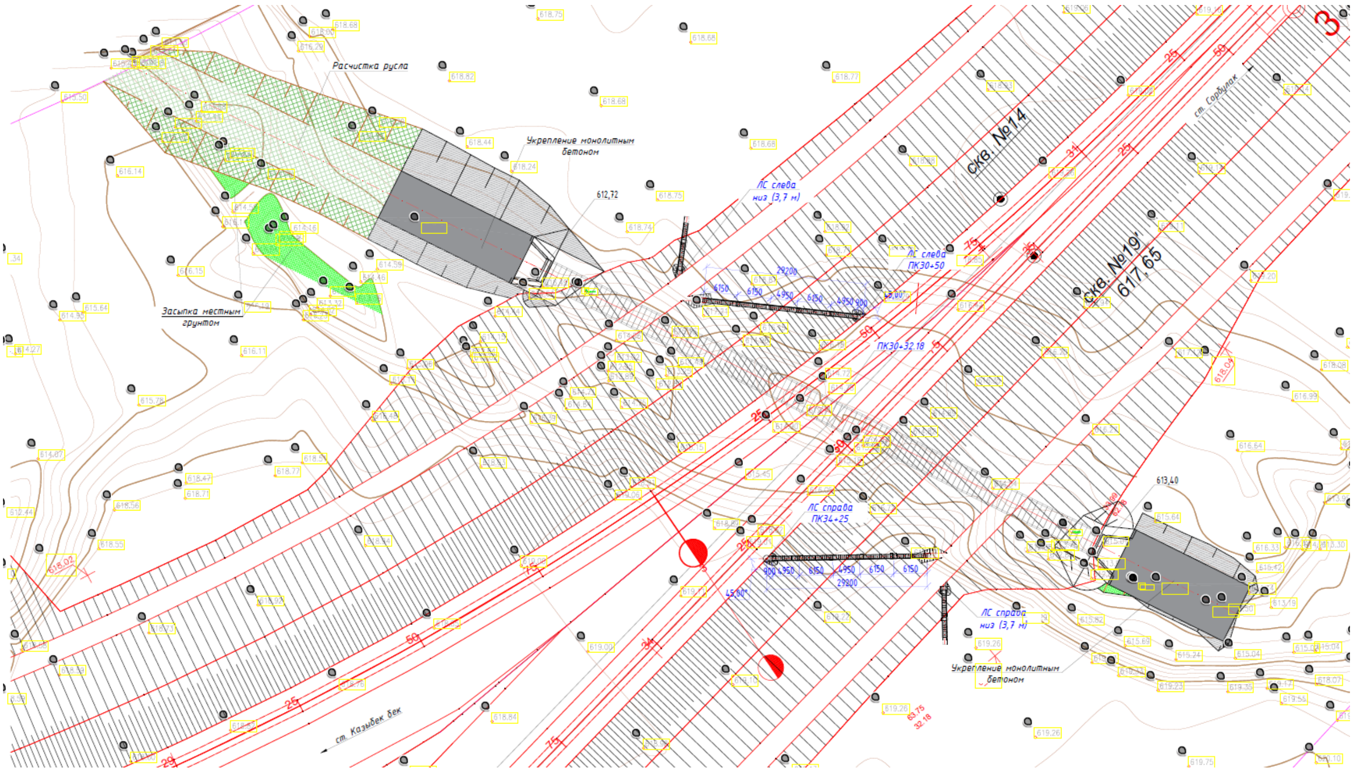


FIGURE 6-24: ENGINEERING DESIGN FOR A PROJECT CULVERT AT THE ZHYNGYLDY RIVER



At Zhetygen Park B Station, there will be locomotive equipment depot including a workshop for maintaining electric and diesel locomotives with concrete flooring. There will also be a fuel depot with diesel fuel storage of capacity 2,000m^3 (material of floor will be concrete).

The total volume of construction wastewater is estimated to be 18,323 m^3/year and the total volume of operations wastewater is estimated to be 18,961 m^3/year. Surface water runoff drainage was not mentioned in the National EIA and no further details were available at the time of writing. Sewage will be generated by railway users and workers at stations during the operation phase. According to the 2024 Waste Management Program[120], the main source of wastewater will be from household wastewater from station facilities and employee residential housing at Kazybek Bek, Sorbulak and Moyinkum stations. In addition to household wastewater, station generated wastewater is anticipated to be collected at Zhana Arna and Zhetygen Stations.

Each station will be equipped with sewage treatment facilities. Station generated sewage will contain greywater and organic waste. Any unplanned sewage discharge from station sewage treatment facilities into the emergency storage tanks will be collected by a sewage truck for disposal/treatment offsite. Sewage treatment facilities at stations include septic tanks and cesspools to receive sewage, gravity and pressure sewerage networks, grease traps, oil separators, sewage pumping stations, biological treatment plants and storage ponds. After water purification, treated water enters the storage ponds. Water in the storage ponds will be used for watering green areas and pavement and driveways. There are no routine discharges of wastewater to surface water courses. Water treatment facilities will be located at the following stations.

- At Kazybek Bek Station, TRIUMPH-75 biological treatment plants with a capacity of 10 m^3/day, a storage pond with dimensions 40m x 42m x 1.7m (2,856m^3) and a 10m^3 storage tanks for emergency discharge of untreated wastewater will be constructed.
- At Moyinkum Station, a TRIUMPH-75 biological treatment plant with a capacity of 15 m^3/day, a storage pond with dimensions 25m x 19m x 1.6m (760m^3) and a 10m^3 storage tanks for emergency discharge of untreated wastewater will be constructed.
- At Sorbulak Station, a TRIUMPH-75 biological treatment plant, a storage pond with dimensions 25m x 21m x 1.3m (682.5m^3) and a 5m^3 storage tank for emergency discharge of untreated wastewater will be constructed.
- At Zhana Arna Station, a biological treatment plant with a capacity of 10 m^3/day, a storage pond with dimensions 30m x 57m x 1.9m (3,249m^3) and a 10m^3 storage tank for emergency discharge of untreated wastewater will be constructed.
- At Zhetygen Station, a biological treatment plant with a capacity of 40 m^3/day, two (2) storage ponds with dimensions 35m x 88m x 2m (6,160m^3) and a 50m^3 storage tank for emergency discharge of untreated wastewater will be constructed.

The main construction and operations activities with potential surface water quality impacts are summarised in **Table 6-62**. The construction schedule is as indicated in **Section 2.2**.

[120] IP "InTech", Waste Management Program for 2024-2033, 2024.

TABLE 6-62: MAIN PROJECT ACTIVITIES WITH POTENTIAL IMPACTS ON SURFACE WATER

No.	Project activity
Construction	
56. 1	Land clearance potentially causing sediment run off
57. 2	Earthworks (excavation and backfilling) potentially causing sediment run off
58. 3	Movement and operations of diesel vehicles and construction machinery on floodplains potentially causing sediment and oil run off
59. 4	Construction of temporary construction roads along the alignment and on rivers and their removal post-construction potentially causing sediment run off
60. 5	Construction of bridges / culverts potentially causing sediment run off
61. 6	Wastewater disposal by third-party subcontractors for two construction labour camps and for the alignment potentially causing organic contaminants and sediment run off
62. 7	Concrete mixing plant near Kazybek Bek Station potentially causing chemicals and sediment run off
Operation	
63. 8	Operation of freight trains on the railway bypass potentially causing sediment and herbicide run off
64. 9	Locomotive maintenance areas and depots potentially causing sediment and oil run off
65. 10	Storage of hazardous chemicals potentially causing sediment and chemical run off
66. 11	Wastewater treatment facilities and wastewater retention ponds at stations potentially causing sediment and organic contaminants run off

Based on the scoping phase exercise following ERM's site visits, the following potential impacts to surface water quality and hydrology were scoped in for assessment:

- **During construction (Impact on surface water quality)**
  - Degradation of surface water quality during construction of the bridges and runoff and erosion from exposed soil surfaces, earthwork areas, soil stockpiles, working in/near water, and transport of soil.
- **During construction (Impact on hydrology)**
  - Increase in stormwater peak flow contributions to watercourses can lead to increased water levels and subsequent floods to surrounding areas adjacent to channels due to land use change from land clearance.
  - Change in hydrological regimes of watercourse due to construction of cross-drainage structures, namely the 48 drainage culverts and seven (7) river crossings (i.e. bridges and culverts).
- **During operations (Impact on water quality and hydrology)**
  - Change in hydrological regimes of watercourse due to construction of cross-drainage structures, namely the 48 drainage culverts and seven (7) river crossings (i.e. bridges and culverts).
  - Occasional leaks or accidental spillages from rolling stock (fuel and lubricants) and locomotive and fuel depots that may occur directly into watercourses.

- Wastewater from maintenance areas, fuel storage and refuelling areas could generate contaminated runoff potentially containing paints, solvents, oil and grease and suspended solids.
- Herbicide used during trackside maintenance activities may cause water quality degradation if not properly managed.

There is no permanent or temporary realignment of riverbeds[121], river strengthening works or water abstraction activities.

6.4.5 ASSESSMENT CRITERIA

6.4.5.1 IMPACT CRITERIA

The assessment criteria for impacts to surface water are based on the prevailing legislation and understanding of the sensitivity of surface water receptors to the Projects construction and operational activities. Separate magnitude criteria's will be used for water quality and hydrology as presented in **Table 6-63** and **Table 6-64**, respectively.

TABLE 6-63: IMPACT MAGNITUDE CRITERIA FOR SURFACE WATER QUALITY

Magnitude	Definitions
Negligible	• Water quality impacts are likely to be well within ambient levels or allowable criteria. • Discharges are expected to be well within statutory limits. • Potential short-term localised effects on water quality but likely to be highly transitory (e.g. lasting a matter of hours) and well within natural fluctuations.
Small	• Water quality impacts are likely to be within ambient levels or allowable criteria. • Discharges are expected to be within statutory limits. • Potential short-term localised effects on water quality but which are likely to return to equilibrium conditions within a short timeframe (e.g. hours or days at most).
Medium	• Water quality impacts are likely to result in occasional exceedances of ambient levels or allowable criteria. • Occasional breach(es) of statutory discharge limits (limited periods) expected. • Potential localised effects on water quality which are likely to be fairly long lasting (e.g. weeks or months) and/or give rise to indirect ecological and/or socio-economic impacts.
Large	• Water quality impacts are likely to routinely exceed ambient criteria levels or allowable criteria over large areas. • Repeated breaches of statutory discharge limits (over extended periods) expected. • Potentially severe effects on water quality which are likely to be long-lasting (e.g. months or more) or permanent and/or give rise to indirect ecological and/or socio-economic impacts.

121 ERM acknowledge the construction of temporary construction roads on earth banks across rivers with large diameter pipe culvert structures to maintain river flows.

TABLE 6-64: IMPACT MAGNITUDE CRITERIA FOR HYDROLOGY

Magnitude	Definitions
Negligible	• There is likely to be negligible or no impact on upstream or downstream flood flows and/or surface or ground water levels by the Project at any time • There is likely to be no alterations to existing drainage regimes and characteristics at any time of year
Small	• There is likely to be some alteration to existing drainage regimes and characteristics, although the frequency and magnitude of flooding upstream or downstream of the Project is not expected to be materially affected • There are no known / expected physical (property, agricultural fields, infrastructure etc.) or sensitive ecological receptors upstream or downstream within the catchment that could be affected by the changed drainage regime • There is likely to be no detrimental effects on existing navigation arrangements
Medium	• The Project is likely to involve significant alterations to existing drainage regimes and patterns (e.g. floodplain embankments, cross drainage structures, canalisation etc.) • There are known / expected physical (property, agricultural fields, infrastructure etc.) or sensitive ecological receptors upstream or downstream within the catchment that could experience an increase in flood frequency (above baseline conditions) as a result of the Project • The Project will likely restrict existing navigation arrangements at certain times
Large	• The Project is likely to involve significant alterations to existing drainage regimes and patterns (e.g. floodplain embankments, cross drainage structures, canalisation etc.) • There are known / expected physical (property, agricultural fields, infrastructure etc.) or sensitive ecological receptors upstream or downstream within the catchment that could experience an increase in flood frequency (above baseline conditions) as a result of the Project • The Project will likely restrict existing navigation arrangements at certain times

6.4.5.2 SENSITIVE RECEPTORS

The sensitivity of receptors identified in the vicinity of the site has been evaluated based on qualitative judgement and understanding of the receiving waters in relation to its baseline state. The criteria adopted for the evaluation are presented in tables below. Separate receptor sensitivity criteria will be used for water quality and hydrology as presented in **Table 6-65** and **Table 6-66**, respectively.

In the event that the different receptors identified in the vicinity of the site fall into a number of categories, the receptors may be assessed individually in the IA.

TABLE 6-65: RECEPTOR SENSITIVITY CRITERIA FOR SURFACE WATER QUALITY

Magnitude	Definitions
Low	The water resource does not support diverse aquatic populations or supports aquatic habitat or population that is of low quality.
Medium	The water resource supports diverse populations of flora and/or fauna
High	The water resource supports economically important or unique aquatic species or provides essential habitat for such species.

TABLE 6-66: RECEPTOR SENSITIVITY CRITERIA FOR HYDROLOGY

Magnitude	Definitions
Low	The water resource has little or no role as a physical regulating service in the hydrologic cycle, and/or the role is highly localised.
Medium	The water resource plays a local or subregional regulating role in the hydrologic cycle in terms of storage, flows and flood alleviation
High	The water resource plays a regional regulating role in the hydrologic cycle in terms of storage, flows and flood alleviation, and one which may have transboundary (international) influences

6.4.6 IMPACT ASSESSMENT

6.4.6.1 CONSTRUCTION PHASE

Impact of Construction Activities on Surface Water Quality

Embedded Controls

The National EIA outlined the following measures to minimise impacts on surface water quality and hydrology in the affected surface water bodies.

- Mandatory compliance of activities within protected shoreline belts and water protection zones with national laws and regulations.
- Measures to prevent soil erosion, gully formation, as well as protective anti-erosion and anti-landslide measures must be implemented. Implementing erosion control measures, such as silt fences and sediment basins, to prevent sediment from entering nearby water bodies. During ERM's site visit from 28 October – 8 November 2024, it was observed that there was no erosion control measures at riverbanks except for stones placed on riverbanks at the Malaya Almatinka River bridge construction site.
- All construction quarries will be backfilled with vegetation planted and areas with disturbed soil and vegetation will be restored to limit exposed soil surfaces and surface runoff after the completion of construction. Perennial grass will be sowed on the surface of fertile soil with mineral fertiliser added.
- Elimination of open storage, loading, and transportation of bulk dusty materials. Instead, containers or specialised transport shall be used.
- Preserving existing vegetation along rivers to filter runoff and reduce sedimentation.
- Employing best practices for handling and storing hazardous materials to prevent spills and leaks that could contaminate surface water.
- Disposing fuel-lubricating materials only at specially designated locations designated for this purpose.
- Collection of domestic wastewaters into tanks for removal in sewerage trucks to offsite wastewater treatment facilities.
- Site cleanup and landscaping to restore vegetation cover after construction is completed.

Considering the potential localised impacts are short term (construction duration of 24 months) the impact magnitude is considered **Medium**. The impact magnitude considers the mandated embedded controls that failed to be implemented during ERM's site visit with appropriate mitigation measures suggested below.

Impact Magnitude

During the construction stage, the deterioration of the surface water quality will mainly be due to increased turbidity. The main factors of influence are the construction of bridges and culverts, runoff and erosion from exposed soil surfaces, earthwork areas, soil stockpiles, working in/near water, and transport of soil.

Surface runoff of soil particles can lead to increased turbidity of water bodies and their silting. Construction sites with disturbed soil and vegetation cover will be subject to erosion processes.

Impact Significance

Based on the review of the available documentation of the watercourses within the Project AoI, in particular the watercourse that will be crossed by the Project, as well as the biodiversity assessment in the watercourses do not support diverse aquatic populations of flora and/or fauna. Therefore, the receptor sensitivity has been assigned as **Low**. As the Impact Magnitude is **Medium**, the resulting Pre-Likelihood Impact Significance is **Minor**. The Impact Significance assessment considered that some embedded controls were not observed to be implemented during ERM's site visit, as mentioned above. ERM has recommended the good practice as detailed below.

The likelihood of unplanned event such as such as sediment runoff from improper management of soil when working near water are assessed to be **Unlikely**. There does not appear to be any specific reports in the past 10 years about water quality pollution directly attributed to the operations of KTZ or railway system in Kazakhstan in general. The Post-Likelihood Impact Significance is evaluated as **Minor**.

Mitigation Measures

No additional measures are required. The following good practice are recommended:

- Develop a stormwater and erosion control plan that includes working in/near water including the following measures:
    - Implement silt fences, sediment traps, or barriers around exposed soil areas and stockpiles to prevent sediment runoff into nearby water bodies.
    - Conduct routine inspections and monitoring, including regular culvert checks and regular cleaning (minimum quarterly).
- Develop a water quality management plan including implementing a weekly surface water quality monitoring programme in compliance with regulatory requirements and best practices during construction works:
    - At locations where construction works should be established for a period of several months (e.g. at bridge crossings and temporary construction roads that cross rivers with drainage pipes installed) or at important social or environmental receptor locations identified downstream
    - Surface water quality monitoring parameters to include dissolved oxygen, Total Suspended Solids (TSS), turbidity and pH.

- Water quality data obtained from the monitoring programme should be compared from upstream and downstream sampling locations.
- Implement corrective actions if monitoring results indicate elevated sediment levels, such as reinforcing sediment control barriers or adjusting site management practices.

Summary

The impact significance for surface water quality due to construction activities is summarised in **Table 6-67**.

TABLE 6-67: IMPACT SIGNIFICANCE OF CONSTRUCTION ACTIVITIES ON SURFACE WATER QUALITY

Category	**Impact before Mitigation**	**Residual Impact**
Nature	Negative	
Type	Direct	
Duration	Short-term	
Extent	Local	
Scale	The impact will not result in a large-scale redistribution of surface run-off	
Frequency	During construction phase only	
Significance	**Minor**	N/A

Impact of Construction Activities on Hydrology

Embedded Controls

The National EIA outlined the following measures to minimise impacts on hydrology in the affected surface water bodies.

- Ensure temporary construction roads built over the affected rivers are removed and the site area is cleaned up of construction debris and general waste after construction.

Impact Magnitude

An increase in stormwater peak flow contributions to watercourses can lead to increased water levels and subsequent floods to surrounding areas adjacent to channels due to land use change from land clearance. There will be a change in hydrological regimes of watercourse due to construction of cross-drainage structures, namely the 48 drainage culverts and river crossings (i.e. bridges). There are known and expected physical residential properties, agricultural fields, hydroelectric power stations, recreational lakes, the Sorbulak Lake System KBA that could experience temporary increases in water levels (above early-stage conditions) as a result of the Project. Still, the Uzyn Kargaly and Zhyngyldy rivers have existing mudflow protection dams, Zhamankyul River has the RBSC and Sorbulak Lake, Kaskelen River has sediment retaining structures at its tributaries, Malaya Almatinka and Karasu Baiserke rivers have dams upstream that regulate flooding. Thus, the impact magnitude is downgraded from **Medium** to **Small**.

Impact Significance

The Project affected rivers play a local or subregional regulating role in the hydrologic cycle in terms of storage, flows and flood alleviation. Therefore, the sensitivity of the receptor is considered **Medium** and the Impact Significance is evaluated as **Minor**.

Mitigation Measures

In addition to the embedded measures, the mitigation measures are as per above.

Summary

The impact significance for hydrology due to construction activities is summarised in **Table 6-68**.

TABLE 6-68: IMPACT SIGNIFICANCE OF CONSTRUCTION ACTIVITIES ON HYDROLOGY

Category	Impact before Mitigation	Residual Impact
Nature	Negative	
Type	Direct	
Duration	Short-term	
Extent	Regional	
Scale	There are likely alterations to existing drainage regimes and characteristics.	
Frequency	During construction phase only	
Significance	**Minor**	N/A

6.4.6.2 OPERATIONAL PHASE

Impact of Railway Operation on Surface Water Quality

Embedded Controls

The National EIA outlined the following measures to minimise impacts on surface water quality and hydrology in the affected surface water bodies.

- Mandatory compliance of activities within protected shoreline belts and water protection zones with national laws and regulations.

There were no embedded controls identified for locomotive and fuel depots at Zhetygen Park B Station.

Impact Magnitude

Occasional leaks or accidental spillages from rolling stock (fuel and lubricants) and locomotive and fuel depots that may occur directly into watercourses or infiltrate into groundwater or wash off into surface waters following heavy rainfall, have the potential to impact water quality due to potential to infiltrate groundwater.

Wastewater generated at the maintenance area will include washdown water and runoff and could potentially contain chemicals (for example, used paints and solvents, oil and grease, and a high concentration of suspended solids) which if it enters watercourses will result in reduction in water quality and would have the potential to infiltrate groundwater.

Fuel storage and refuelling areas would be a potential source of leaks and spills which would have the potential to impact water quality including due to potential to infiltrate groundwater.

Application of herbicide use during trackside maintenance activities has the potential to result in water quality and associated impacts if improperly managed.

Sewage will be generated by railway users and workers at stations during the operation phase. Uncontrolled discharge of domestic and sanitary wastewater is generally characterised as having a high concentration of solids (suspended and dissolved), oil and grease, biochemical oxygen demand (BOD) and chemical oxygen demand (COD), nutrients (ammonia) and E. coli counts. Treated wastewater will be reused for greening at stations.

With the implementation of sewage treatment facilities, water quality impacts are likely to be within ambient levels or allowable criteria. However, there were no controls identified for locomotive and fuel depots at Zhetygen Park B Station. As such, the impact magnitude is considered **Medium**.

Impact Significance

Based on the visual assessment and review of the available documentation of the watercourses within the Project AoI, as well as the biodiversity assessment the watercourses do not support diverse aquatic populations of flora and/or fauna. Therefore, the receptor sensitivity has been assigned as **Low**. As the Impact Magnitude is **Medium**, the resulting pre-likelihood impact significance is evaluated as **Minor**.

The likelihood of unplanned event such as such as accidental spillages from rolling stock (fuel and lubricants) and locomotive and fuel depots are assessed to be **Unlikely**. There does not appear to be any specific reports in the past 10 years about water quality pollution directly attributed to the operations of KTZ or railway system in Kazakhstan in general. The post-likelihood impact significance is evaluated as **Minor**.

Mitigation Measures

No additional measures are required. The following good practice are recommended:

- Permanent wastewater treatment facilities will be established for all stations and locations where employees will regularly work and with sufficient capacity for other rail users. The wastewater treatment facilities should be designed and operated to meet the Project Discharge Standards for Treated Sanitary Sewage.
- All runoff water from the locomotive and fuel depots at Zhetygen Park B Station should be collected in appropriate drainage structures for oil separation and sedimentation to meet the Project discharge standards for stormwater.
- Storm water generated from depot sites, roof areas and outdoor paved floor area should be treated through the collection and drainage system with settling pits for the treatment of suspended solids, garbage, mud etc.
- As part of the Operations and Maintenance Plan (O&M Plan), oils, fuels and chemicals should only be used and stored in designated areas which have pollution prevention facilities. All fuel tanks and storage areas should be provided with locks and be sited on sealed areas, 110% of the capacity of the largest tank or 25% of the total capacity of all the tanks within the bund whichever is the greater. The bund should be drained of rainwater after a rain event. The O&M Plan is further detailed in the ESMP.

- Fixed fuel storage infrastructure should be on flat, impermeable surface and surrounded by a bund with 110% of the capacity of the storage tank(s), and fuel transfer at fixed stations should be performed on a concrete surface draining to a mechanical oil separator.
- Proper guidelines and procedures should be developed for immediate clean-up actions following any spillages of oil, fuel or chemicals.
- All drainage structures and sediment and erosion control measures should be inspected and maintained on a regular basis, including clearance of channels or silt traps during the wet season.
- Herbicide chemicals should be selected in accordance with IFC EHS Guidelines for railways, and trackside maintenance staff will be trained in the safe application of herbicides, including controls on their use in the vicinity of surface water bodies as described in Section 1.1.1 of the IFC EHS Guidelines for Railways. This should include their safe handling, storage and transport, weather restrictions on use, and maintaining appropriate buffer zones adjacent to water bodies during application. Selected herbicide application shall be applied with use of a pesticide logbook to record data as part of the O&M Plan.

Summary

The impact significance for surface water quality due to operations activities is summarised in **Table 6-69.**

TABLE 6-69: IMPACT SIGNIFICANCE OF OPERATION ACTIVITIES ON SURFACE WATER QUALITY

Category	Impact before Mitigation	Residual Impact
Nature	Negative	
Type	Direct	
Duration	Long-term	
Extent	Local	
Scale	Deterioration of surface water quality due to increased turbidity and contaminants from runoff.	
Frequency	Throughout operations phase.	
Significance	**Minor**	N/A

Impact of Railway Operations on Hydrology

Embedded Controls

The National EIA outlined the following measures to minimise impacts on surface water quality and hydrology in the affected surface water bodies.

- Mandatory compliance of activities within protected shoreline belts and water protection zones with national laws and regulations.
- Drainage control plans to manage potential flooding. At the time of writing, no drainage control plans were available.

Impact Magnitude

The permanent infrastructure (bridges and culverts) along the railway has the potential to disrupt local drainage patterns and cause upstream flooding by restricting high flows if they are inadequately sized or designed. If improperly constructed, culverts could also impede low flows. Cross-drainage structures with insufficient capacity would reduce upstream velocity in the watercourse leading to increased sediment deposition and increase velocity downstream of the structure potentially increasing localised erosion rates (scour) resulting in increased turbidity downstream.

As mentioned in the above sections, the 2023 Hydrometeorological Report[122] had carried out discharge calculations for various return periods, such as 2-year, 4-year, 10-year, 25-year, and 100-year floods. The 100-year return period flood (1% Probability Exceedance flood) has been adopted for the design of Project bridges, following the guidelines specified in "SME 3.04-101-2005: Determination of the Main Design Hydrological Characteristics." The discharges for 100-year return period were estimated to determine the bridge design levels. However, the report does not provide detailed calculations or design parameters demonstrating how these discharges were specifically applied to the structural design of all Project bridges. ERM notes that international standard industry practice is for bridges and culverts to be designed to convey a peak flood flow with an estimated 100-year Average Recurrence Interval (Q100). However, it is only mentioned that the 100-year return period discharge has been used for designing the bridges, with the exact methodology or design considerations associated with this discharge not presented.

In addition, the consideration of climate change was not factored into the 2023 Hydrometeorological Report[123] calculations which may potentially reduce the lifespan of the Project infrastructure and railway serviceability. However, as the Project bridge designs include additional freeboard, the risk of such an impact may be minimal. Furthermore, the potential for cross-drainage structures installed for the railway to result in flooding upstream during high flow periods is reduced to national industry standard acceptable levels through adoption of the national design standard, which allows conveyance of estimated 1% flood risks. Still, there may be rare instances were known and expected physical residential properties, agricultural fields, hydroelectric power stations, recreational lakes, the Sorbulak Lake System KBA experience a temporary increase in water levels (above early-stage conditions) because of the Project. Considering the affected rivers have existing mudflow protection dams and irrigation dams upstream and downstream that regulate flooding, the impact magnitude is downgraded from **Medium** to **Small**.

Impact Significance

The Project affected rivers play a local or subregional regulating role in the hydrologic cycle in terms of storage, flows and flood alleviation. Therefore, the receptor is considered **Medium**. As the impact magnitude is **Small**, the resulting impact significance is evaluated as **Minor**.

[122] Technical Report Based on the Results of Engineering and Hydrometeorological Surveys for the Preparation of Project Documentation 754189/2022/1-Y.3, Poligram, 2023
[123] Technical Report Based on the Results of Engineering and Hydrometeorological Surveys for the Preparation of Project Documentation 754189/2022/1-Y.3, Poligram, 2023

Mitigation Measures

No additional measures are required on the design. The following good practice for the design may be considered if possible:

- Poligram to update the 2023 Hydrometeorological Report[124] to include more details on Project bridge design discharge calculations for 100-year return period with climate change scenarios to verify the impact significance.
- Set up an early warning system to alert potential flooding at Project bridges that sends automated alerts via sirens or other communication systems when thresholds are exceeded.

Due to the possibility of clogging of culverts, it is recommended:

- A culvert maintenance plan should be designed and implemented as part of the Operation and Maintenance (O&M) Plan as detailed in the ESMP.

Summary

The impact significance for surface water quality due to operations activities is summarised in **Table 6-70.**

TABLE 6-70: IMPACT SIGNIFICANCE OF OPERATIONAL ACTIVITIES ON HYDROLOGY

Category	Impact before Mitigation	Residual Impact
Nature	Negative	
Type	Direct	
Duration	Short-term	
Extent	Regional	
Scale	There are likely alterations to existing drainage regimes and characteristics.	
Frequency	Throughout operations phase	
Significance	**Minor**	N/A

[124] Technical Report Based on the Results of Engineering and Hydrometeorological Surveys for the Preparation of Project Documentation 754189/2022/1-Y.3, Poligram, 2023

6.5 SOIL AND GROUNDWATER QUALITY

6.5.1 APPLICABLE REFERENCE FRAMEWORK

Applicable laws, directives, policy and guidance for soil and groundwater impacts are outlined in **Table 6-71.**

TABLE 6-71: SOIL AND GROUNDWATER APPLICABLE REGULATIONS AND GUIDELINES

Title	Year
Law	
Environmental Code of the Republic of Kazakhstan No. 400-VI ZRK.	2021
The Water Code of the Republic of Kazakhstan.	2024
"On Subsoil and Subsoil Use" No. 125-VI, enacted on 27 December 2017, amended on 28 December 2023.	2023
The Land Code (RK Code #442-II, adopted 20 June 2003, with last amendment on 21 May 2024)	2024
Policy	
IFC Environmental, Health, and Safety Guidelines for Railways.	2007
IFC General Environmental, Health, and Safety (EHS) Guidelines.	2007

6.5.2 EARLY-STAGE CONDITIONS

The following information was referenced in the assessment of the existing soil and groundwater conditions:

1. National EIA report by InTech LLP, 2023.
2. Engineering and Geological Works report, San Munagas LLP (San Munai Gas) 2023.
3. Technical Report Based on the Results of Engineering and Hydrometeorological Surveys for the Preparation of Project Documentation 754189/2022/1-Y.3, Poligram, 2023
4. Findings from ERM’s site visit on 28 October – 8 November 2024.
5. ASTER Global Digital Elevation Model (GDEM) data obtained in 2013.

6.5.2.1 GEOMORPHOLOGY

Figure 6-25 shows the ASTER Global Digital Elevation Model (GDEM) data obtained in 2013, which indicates that the railway alignment is predominantly situated on flat terrain, with a decreasing elevation trend toward the east. The elevation ranges from 510 to 620m above sea level.

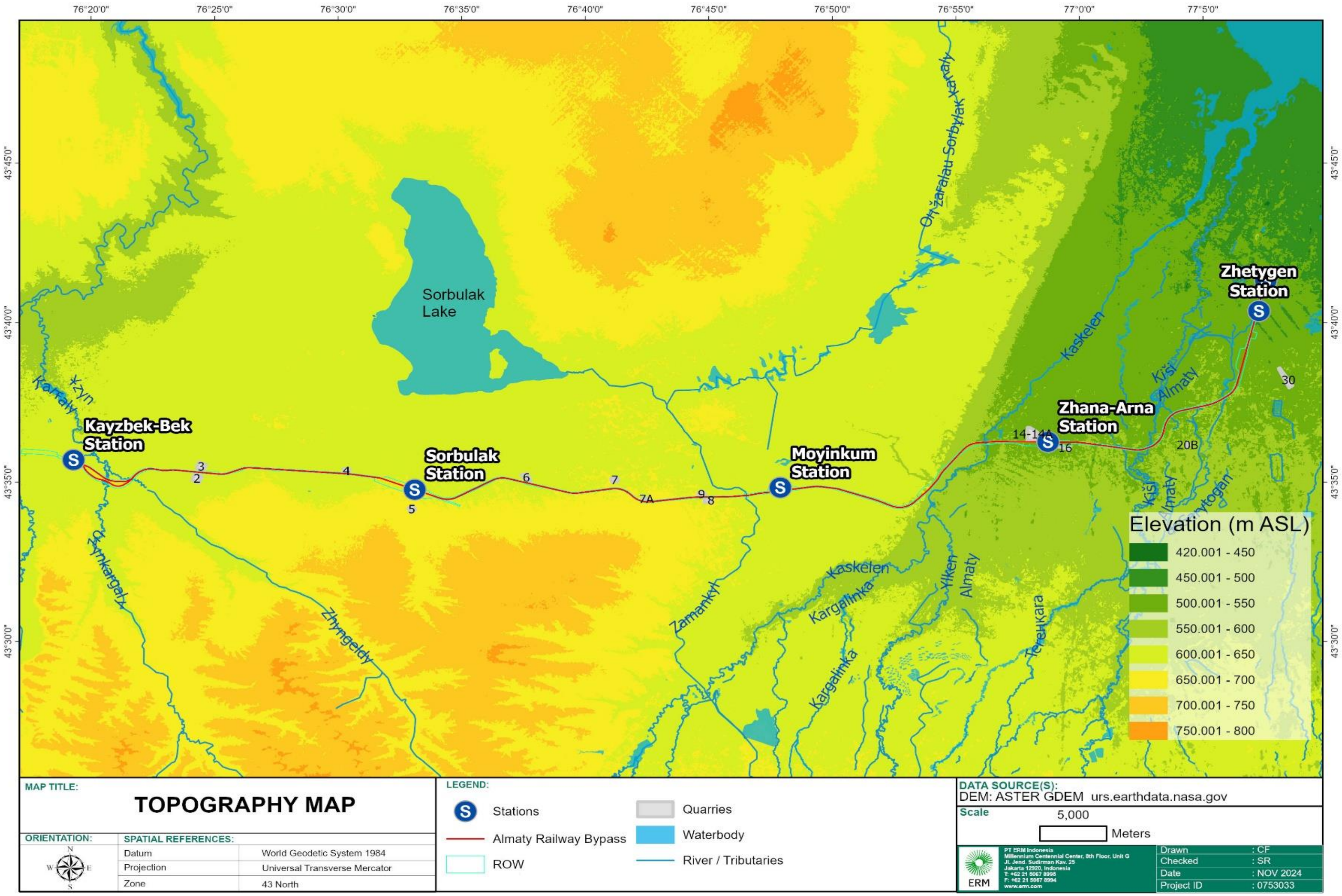
The Project is located on the Ili Depression with the Trans-Ili Alatau and Dzungarian Alatau mountain ranges towards the south and the predominantly flat Bozoy Plateau and Karaoi Valley towards the north[125]. The Trans-Ili and Dzungarian Alatau mountain ranges, part of the larger Tian Shan mountain system, surround and descend into the Ili Depression by a series of stepped fault-ledges resembling giant stairs. These steps form vertical zones with distinct relief types shaped by geological structures and tectonic activity, influenced by vertical

[125] Technical Report Based on the Results of Engineering and Hydrometeorological Surveys for the Preparation of Project Documentation 754189/2022/1-Y.3, Poligram, 2023

climatic zone. The Ili Depression, averaging below 1,000m above sea level, is characterized by slightly undulating plains with small hills and shallow logs, though some areas are flat. The western part, west of the Kaskelen River, stands out for its higher elevation and more uneven, hilly terrain with steep slopes. Along railway alignment, three main plain types are identified: alluvial-proluvial piedmont sloping plains, alluvial terraced plains, and alluvial plains with aeolian treatment.

The route intersects several rivers, including Uzyn Kargaly, Zhyngyldy, Zhamankyul, Kaskelen, Malaya Almatinka, and Karasu Baiserke rivers as well as irrigation canals. The river waters are used for irrigation of arable land, watering pastures. These rivers, primarily fed by glacial and mixed sources, are part of the Balkhash basin, with Karasu being mostly glacier-fed. While their flows are regulated, summer floods are observed on the river. Ponds and small reservoirs are located south and upstream of the project.

FIGURE 6-25: TOPOGRAPHY MAP



6.5.2.2 GEOLOGICAL AND LITHOLOGICAL STRUCTURES

The Ili Depression has a complex geological structure featuring various formations from the Paleozoic to the Quaternary periods. Mountain ranges are primarily composed of Middle Paleozoic rocks, while the depression contains thick sedimentary deposits from the Cenozoic era, including Paleogene, Neogene, and Quaternary formations. Key deposits include alluvial-proluvial sediments, ferruginous conglomerates, sandstones, clays, and gravels, with significant variations in composition and thickness. Subsurface studies reveal that Quaternary deposits dominate near the surface, comprising sandy loams, loams, and silty clays interspersed with carbonate fragments and gravel. The soils show varying salinity and subsidence properties, particularly in the upper 4-meter layer, which is prone to settlement due to groundwater saturation and natural consolidation.

The plains, characterized by alluvial-proluvial deposits, serves as an accumulation zone for fine clastic material from mountain slopes. The bedrock lies at depths ranging from 10 to 500 meters, based on exploratory drilling and geophysical studies. Near the rail alignment, geological foundation consists of middle and upper Quaternary deposits, including gravel-pebble layers up to 15 meters thick. These characteristics are critical for assessing soil stability, subsidence risks, and construction challenges for the proposed infrastructure.

The Engineering and Hydrometeorological Study describes the soil cover as diverse. Black soils and thin loamy soils are found on elevated ridges, while medium-thick chernozems and meadow-chernozems dominate the plains. Saline soils form in inter-ridge depressions and lacustrine hollows. In the plains, extensive areas of sands, salt marshes, and takyrs are present, characterized by wormwood and mixed vegetation.

6.5.2.3 HYDROGEOLOGICAL / GROUNDWATER CONDITIONS

The hydrogeological conditions of the project area are complex, characterized by a range of aquifer types and varying groundwater depths. Perched water occurs sporadically at elevations above local erosion bases, typically confined to sandy and sandy-loam lenses overlying clayey and loamy aquifers. These perched aquifers are located 0.5m to 4-5m below the surface with thickness of no more than 2m and are subject to irregular seasonal variations. Groundwater and low-pressure aquifers occur at depths of 0.5m to 4m. Groundwater levels fluctuate seasonally, rising by 0.5m to 2m during snowmelt. In some areas, the groundwater level will depend on the availability of water in the irrigation system. Along the alignment, groundwater is used for domestic and farming purposes (not for drinking).

The Upper Quaternary alluvial aquifer is prominent within river valleys, floodplains, and terraces of the Ili, Kaskelen, and Bolshaya and Malaya Almatinka rivers. Groundwater depth ranges from 0.5m to 7m, with aquifer thickness varying between 10m and 20m. The discharge of springs recorded in the floodplains of rivers varies widely, ranging from 0.01 to 9-11 l/s. In the cliffs of the first terraces above the floodplain, ascending springs have discharges between 4-5 l/s and 20-45 l/s.

The project area benefits from significant groundwater recharged from:

- Mountain runoff from the Trans-Ili Alatau.
- Infiltration of river waters.
- Seasonal snowmelt and precipitation.
- Irrigation systems that influence groundwater levels

Water salinity varies geographically; fresh groundwater (0.3 g/L) is predominant in the east, while salinity increases to 35 g/L in the west near Neogene gypsum-bearing clays. Middle-Upper Quaternary aquifers, consisting mainly of alluvial-proluvial deposits, extend across the interfluvial and riverine areas. These aquifers exhibit hydraulic connectivity between upper and lower layers and are primarily fed by groundwater flow from foothills, aligning with surface runoff toward the Ili River. Pressure aquifers, located at depths of 15m - 130m, are composed of pebbles and sands with variable thickness (2m - 125m) and are interspersed with connected aquitards.

In riverine zones, aquifers comprise up to 75% of the sedimentary thickness, and groundwater typically lies 5m - 15m below the surface, with fresher water closer to the mountains. Salinity in stagnant zones can reach 1-3 g/L.

Depth to groundwater along the project route varies but is still considered shallow (<15m below ground) and likely vulnerable to spills in highly permeable areas such as riverine zones.

6.5.2.4 PHYSICAL AND MECHANICAL PROPERTIES OF SOILS

The railway design alignment traverses an area with diverse physical and geological features and processes. The varied landforms and geological conditions within the Ili Depression contribute to the active occurrence of phenomena such as deflation, erosion or rock falls, landslides, mudflow, weathering, soil subsidence, seismic-induced deformations, seasonal soil freezing, and frost heaving.

6.5.2.5 SEISMICITY

National design code SP RK 2.03-30-2017 classifies soils into four soil categories based on seismic properties with the description of each soil category being provided in **Table 6-72**.

TABLE 6-72: GROUND CHARACTERIZATION ADHERING TO SP RK 2.03-3-2017

Soil Category	Properties
IA	Unweathered and slightly weathered rock with vs,30 ≥ 800 m/s
IB	Weathered rock and coarse-grained soil from igneous rock with ρ ≥ 2.15 t/m3 and 550 m/s ≤ vs,30 < 800 m/s
II	Strongly weathered rock, coarse-grained soil from sedimentary rock, dense and medium dense coarse- and medium-grained soil, silty sand and clay with LI ≤ 0.5 and e < 0.9 for clay and loam and e < 0.7 for sandy loam and 270 m/s ≤ vs,30 < 550 m/s
III	Loose sand, medium dense coarse- and medium-grained sand, dense and medium dense small-grained and silty sand, clay with LI > 0.5 and clay with LI ≤ 0.5 and e ≥ 0.9 for clay and loam and e ≥ 0.7 for sandy loam with vs,30 < 270 m/s

According to the Engineering and Geological Report[126], recent uplifts in the Tian Shan mountains resulted in the current seismic risk of up to magnitude 9 (Destructive)[127] in the Project area. However, considering the area's geological cross-section exhibits heterogeneity, and the hydrogeological and engineering-geological conditions are complex, the seismic magnitude may vary by 1.0 point upwards or downwards on the Richter Scale.

[126] Engineering and Geological Works report, San Munagas LLP (San Munai Gas) 2023
[127] Magnitude corresponds to MSK-64 scale

According to Kazakhstan construction regulation SP RK 2.03-30-2017, the soil category at the project area is predominantly classified as Category II. However, in locations where the soil profile includes plastic cohesive soils or water-saturated sands with a groundwater level above 5m (considering seasonal fluctuations), the soil category changes to Category III.

6.5.2.6 SOIL AND GROUNDWATER QUALITY

No information is available on baseline soil and groundwater quality during the early stage of the project for review. No previous soil and groundwater sampling has been reportedly conducted.

6.5.2.7 SITE OBSERVATION

The landcover within the railroad alignment consists of:

- Semi-desert with certain portions retaining natural characteristics despite grazing pressures;
- Pastureland agriculture with significant grazing activity was observed at agriculture land;
- Waterbody including floodplains and reedbeds;
- Open scrub vegetation; and
- Small portion of built-up areas.

Tree lines, intentionally planted to act as natural barriers against drifting snow were observed along the railway alignment. These, along with access tracks and field boundaries, are inherently linked to agricultural and grazing practices and emphasize the anthropogenic influence on the landscape.

The Project includes 14 quarries[128] that would be used for soil and substrate for earthworks. ERM personnel captured photographs at 10 quarry locations, with the observation locations shown in **Figure 6-26**. During the site visit, two groundwater extraction wells were identified—one located at a farmland and the other at workers' accommodation.

Due to previous information provided by KTZ (kml[129] files) indicating 10 quarry locations, and verbal confirmation from KTZ during the site visit on the above, the additional wells and quarries could not be visited during the site visit. The photographs and visual observation summary are presented in **Table 6-73**.

[128] Обводной с карьеарами.kmz, KTZ, received on 7 November 2024
[129] All quarries.kml, KTZ, received on 27 September 2024

FIGURE 6-26: SOIL AND GROUNDWATER OBSERVATION LOCATIONS

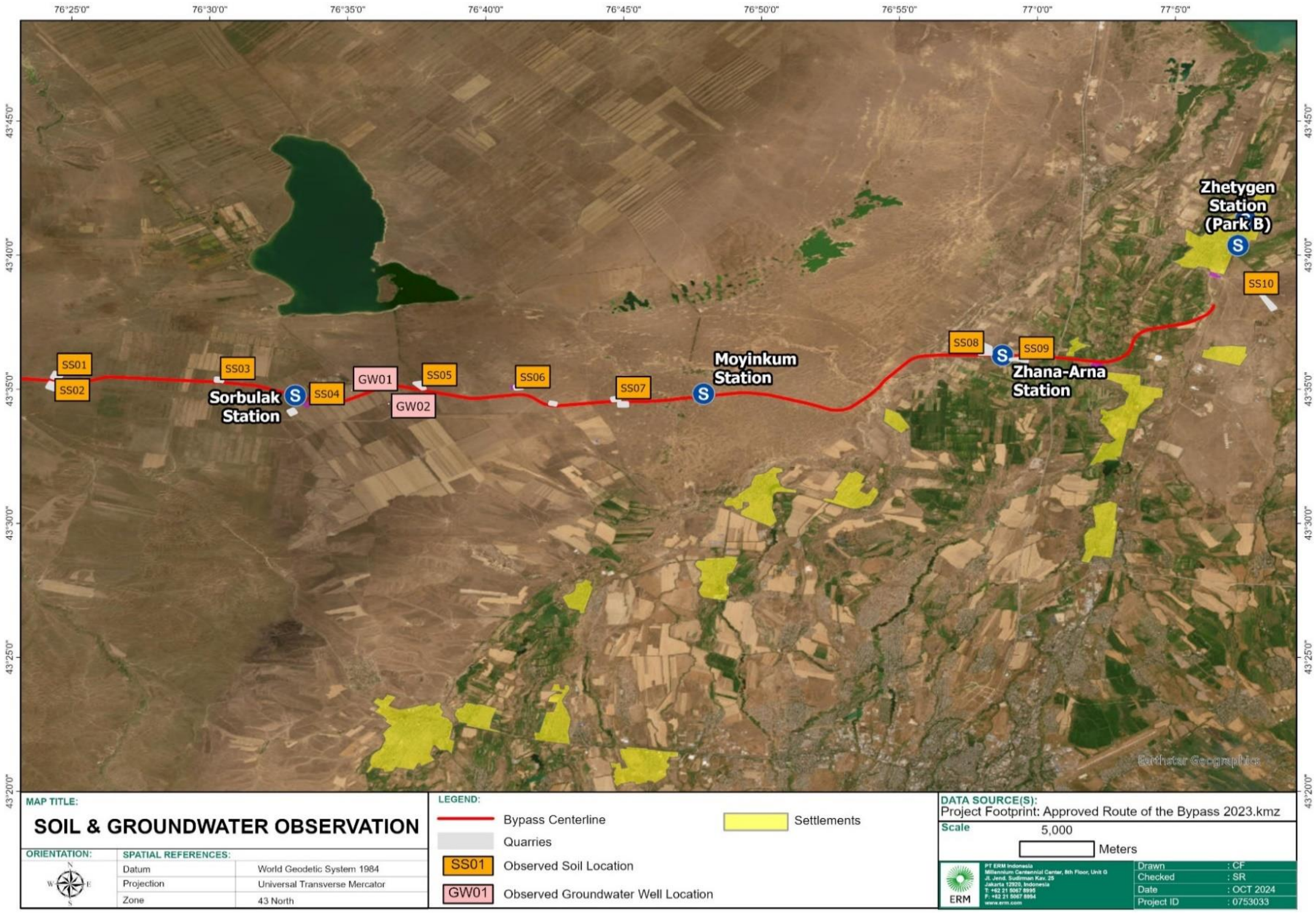


TABLE 6-73: VISUAL OBSERVATION SUMMARY OF SOIL AND GROUNDWATER RESOURCES

Location and Photograph	Observation[130]	Surrounding Land Use and Other Remarks
SS01 Unnamed quarry 	• Area ~1 hectare • Light brown colour • Sand and clay • Compacted • No flooding, dry (rain event 2-3 days prior), dusty in summer months • No organic matter, plant and weed growth within quarry, outside boundary of quarry there are small shrubs/ trees • No surface crust • Small amounts of litter, no chemicals used on site, no oil sheen observed	• No surrounding land use • No quarry wall reinforcement observed
SS02 Unnamed quarry	• Area ~1 hectare • Light brown colour • Sand and clay • Compacted • No flooding, dry, dusty in summer months • No surface crust • No organic matter, plant and weed growth within quarry • Small amounts of litter, no chemicals used on site, no oil sheen observed	• Surrounding land use: cattle farming • No quarry wall reinforcement observed

[130] Pollution sources, colour, size (sand/silt/clay), structure (compact/aggregated), dry/wet, presence of organic matter, plant growth, surface crust, weed growth and litter.

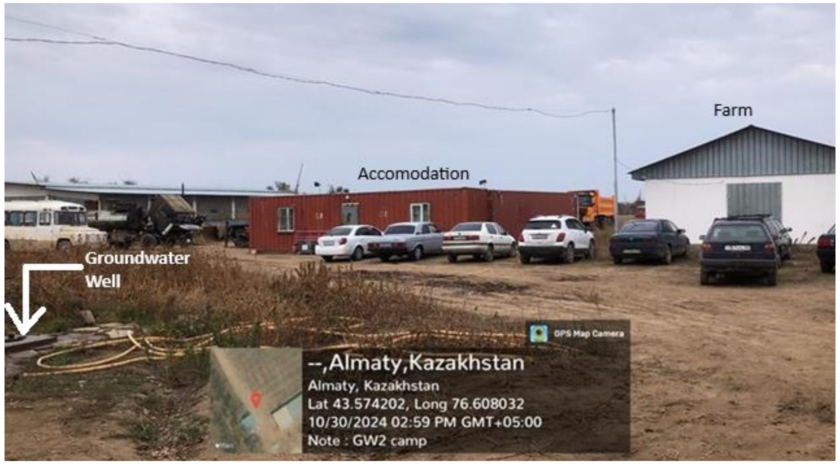
Location and Photograph	Observation[130]	Surrounding Land Use and Other Remarks
		
SS03 Unnamed quarry 	• Area ~1 hectare • Yellow-brown colour • Mostly clay and some sand • Compacted • No flooding, dry, dusty in summer months • No surface crust • No organic matter, plant and weed growth within quarry, outside boundary of quarry there are small shrubs/ trees. • Small amounts of litter, no chemicals used on site, no oil sheen observed	• No surrounding land use • No quarry wall reinforcement observed

Location and Photograph	Observation[130]	Surrounding Land Use and Other Remarks
SS04 Unnamed quarry 	• Area ~1 hectare • Yellow-brown colour • Compacted • No flooding, dry, dusty in summer months • No surface crust • No organic matter, plant and weed growth within quarry, outside boundary of quarry there are small shrubs/ trees. • Small amounts of litter, no chemicals used on site, no oil sheen observed	• Surrounding land use: wheat farm • No quarry wall reinforcement observed
SS05 Unnamed quarry 	• Area ~1 hectare • Brown colour • Clay ~70%, sand ~30% • Compacted • Wet with some flooding after rain events • No surface crust • No organic matter, plant and weed growth within quarry, outside boundary of quarry there are small shrubs/ trees • Small amounts of litter, no chemicals used on site, no oil sheen observed	• Surrounding land use: cattle farm. Cattle observed within quarry. • No quarry wall reinforcement observed

Location and Photograph	Observation[130]	Surrounding Land Use and Other Remarks
SS06 Unnamed quarry 	• Light brown colour • Clay and sand • Compacted • Dry • Snowing with certain areas covered with snow on the ground at the time of survey • Some short grass/ plants in the quarry • No surface crust • Insignificant amounts of litter	• Agriculture/vegetable farms
SS07 Unnamed quarry 	• Area ~2 hectares • Light brown colour • Mostly sand, some loam • Compact • Some grasses in the quarry • No surface crust • Small amount of litter	• Vegetable farms • Shrubs/grasses lining the outside fringe of the quarry

Location and Photograph	Observation[130]	Surrounding Land Use and Other Remarks
SS08 Unnamed quarry 	• Dark brown colour • Compact	• Agricultural fields and irrigation canals
SS09 Unnamed quarry 	• Brown colour • Loamy • Compact • Dry • No organic matter, plant and weed growth within quarry, outside boundary of quarry there are small shrubs/ trees and reed thickets • Small amounts of litter	• Agricultural fields. • Top 1 meter of soil removed and placed on the borders of quarries as a "fence"

Location and Photograph	Observation[130]	Surrounding Land Use and Other Remarks
SS10 Unnamed quarry 	• Current area ~1-2 hectares, maximum quarry size is allocated at 13.5 hectares. • Brown colour • Mainly clay, some white salt crystals observed • Compacted • Damp (not wet) after rain events, no flooding • No surface crust • No organic matter, plant and weed growth within quarry, outside boundary of quarry there are small shrubs/ trees. • No litter, no chemicals used on site, no oil sheen observed	• Surrounding land use: cattle farm • No quarry wall reinforcement observed
GW01 Farmland 	• One groundwater well at existing farmland • ~150 meters depth • Construction dust observed surrounding groundwater resource	• Construction groundwater is supplied from the overhead hose to water carrying trucks • Farmland stores water in trough lined with black material for use
GW02 Worker's accommodation	• One groundwater well at existing farmland • Traffic dust from roads	• Water supply is provided by an existing groundwater well that is part of the farmland.

Location and Photograph	Observation[130]	Surrounding Land Use and Other Remarks
		

6.5.3 POTENTIAL SOURCES OF IMPACT

Construction phase

The key Project activities that may impact the soil and groundwater during the construction phase include[131,132]:

- Earthworks: The volume of soil to be excavated is an estimated 1,562,619 m^3. The volume of soil to be filled is an estimated 4,658,989 m^3. The total earthworks volume is an estimated 6,221,608 m^3.
    - According to project construction schedule, the excavation work duration is 13 months and backfilling work duration is 15 months. All construction quarries will be levelled with vegetation planted and areas with disturbed soil and vegetation will be restored to limit exposed soil surfaces and surface runoff after the completion of construction. Perennial grass will be sowed on the surface of fertile soil with mineral fertilizer added.
    - Crushed stone supply for track ballast and pavement base is sourced from Malaysary station, approximately 120km from the construction site. Track ballast will be transported by train to Zhetygen Station in hopper dispensers while the pavement base will be transported by truck along the route.
- Transport Movement: Increase of heavy vehicles and machineries activities within the existing roads parallel to the railway alignment, on the railway line, at construction sites for bridges, rail crossings, stations and infrastructure which may lead to soil compaction, erosion, loss of soil fertility and pollution.
- Chemical Use: Some construction activities, as shown in **Table 6-74** below, involve use and emission of chemical that may contaminate the soil and groundwater and also affect soil fertility.

TABLE 6-74: KEY POTENTIAL SOURCES OF CONTAMINATION FOR SOIL AND GROUNDWATER IN CONSTRUCTION PHASE

No	Key potential source of contamination	Potential soil and groundwater pollutants
1	Welding	• Suspended particles • Manganese Oxides
2	Painting works	• Suspended solids • Xylene • Acetone • Toluene • Alcohol n-butyl • White spirit • Alcohol Isobutyl
3	Waterproofing	Hydrocarbons
4	Asphalt paving	Hydrocarbons
5	Compressor with internal combustion engine	• Hydrocarbons

[131] IP "InTech". (2023). Environmental Impact Assessment (EIA).
[132] FE "InTech". (2024). Industrial Environmental Control Program, Almaty.

No	Key potential source of contamination	Potential soil and groundwater pollutants
		• Soot • Dioxid myrrh • Benz(a)pyrene
6	Mobile Diesel Power Plant	• Hydrocarbons • Soot • Dioxid myrrh • Benz(a)pyrene
7	Bitumen boiler	• Soot • Hydrocarbons
8	Welding unit (diesel)	• Hydrocarbons • Soot • Dioxid myrrh • Benz(a)pyrene
9	Rotational camp. Boiler room	Benzapyrene
10	Rotational camp. Emissions from fuel discharge into the tank	• Propane Bhutane • Ethyl mercaptan
11	Rotational camp. Diesel generator	• Hydrocarbons • Soot • Dioxid myrrh • Benz(a)pyrene
12	Rotational camp. Tank for diesel generators.	Limiting hydrocarbons C12-C19
13	Rotational camp. Laundry room.	• Discharge of laundry detergent • Caustic soda
14	Rotational camp. Kitchen	• Suspended solids • Ethyl alcohol • Acetic acid • Acrolein
15	Rotational camp. Bath.	Benzapyrene
16	Bleed Candle	Ethyl mercaptan

- According to the National EIA on waste and wastewater generation during the construction period, the total waste generated is expected to be 79,449.02 tons, including the following categories:
    - Paint and varnish containers: 1.6675 tons
    - Oily rags: 0.852 tons
    - Solid household waste: 1,946.2 tons
    - Welding electrode cinders: 0.07575 tons
    - Construction waste: 77,500 tons

  Waste designated for disposal will be transferred to specialised organisations, while the remainder will be sent to a solid waste landfill.

- Groundwater use: The National EIA discussed water demand for the construction phase is calculated as per SP RK 4.01-101-2012. The primary water requirements are for household and industrial purposes.

- **Domestic Water Needs:**
  - Total workers: 1,004 persons
  - Daily water consumption rate per worker: 25 Litres
  - Total daily water consumption:
    $1{,}004 \times 25/1{,}000 = 25.1\ m^3/day$
  - Total consumption for the construction period (730 days):
    $25.1 \times 730 = 18{,}323\ m^3$

- **Technical and Industrial Water Needs:** Water required for production, including concrete preparation: 75,731.2 m^3

To meet construction water demands, water will be sourced from existing wells along the project route. As per EIA, there is sufficient groundwater source for construction activities and will not significantly affect groundwater availability for other users. The locations of the nine (9) wells are:

1. PK 63: 400 m left of the site, abandoned well, water level at -8 m.
2. PK 75: 100 m right, located on a small farmland.
3. PK 100: 3,700 m left, located on a small farmland.
4. PK 155: 800 m right, located on a small farmland
5. PK 180: 400 m right, located on a small farmland.
6. PK 230: 900 m left, located on a small farmland
7. PK 275: 100 m left, located on a small farmland.
8. PK 300: 1,400 m left, located on a small farmland.
9. PK 376+09: Discharge canal, Sorbulak.

Operational Phase

According to Industrial Environmental Control Program, the key Project activities that may impact the soil and groundwater during the construction phase include:

- Train operation and heavy vehicular activities: Operation of train and heavy vehicular activities potentially caused soil erosion and compaction, which can lead to reduced soil permeability, increase surface runoff, and decreased water infiltration.
- Chemical use and storage: Some operation activities, as shown in **Table 6-75** below, involve use and emission of chemical that may contaminate the soil and groundwater.

TABLE 6-75: KEY POTENTIAL SOURCES OF CONTAMINATION FOR SOIL AND GROUNDWATER IN OPERATION PHASE

No	Key potential source of contamination	Potential soil and groundwater pollutants
1	Fuel storage tank	• Benz(a)pyrene • Soot • Limiting hydrocarbons C12-C19
2	Gas storage emissions from fuel discharge into the tank	• Limiting hydrocarbons C12-C19 • Ethyl mercaptan

No	Key potential source of contamination	Potential soil and groundwater pollutants
3	Gas storage tank blowdown emissions	• Ethyl mercaptan
4	Boiler Room	• Ethyl mercaptan • Benz(a)pyrene • Soot
5	Diesel generator	• Hydrocarbons • Soot • Dioxid myrrh • Benz(a)pyrene
6	Compressor station	• Mineral oil
7	Administrative and amenity building	• Calcium hypochlorite dust • Laundry detergent emission • Caustic soda
8	Point of control and technical inspection of wagons	• Manganese oxides • Suspended particles • Abrasive dust
9	Rest house for locomotive crews	• SMS Dust • Caustic Soda • Calcium hypochlorite dust
10	Locomotive Equipment and Inspection Depot	• Emissions of oil vapours
11	Drying oven	• Nitric Dioxide Nitric Oxide • Carbon monoxide Benzo(a)pyrene Sulphur dioxide Soot
12	Sand warehouses (pneumatic transport)	• Inorganic dust
13	Diesel shunting locomotive	• Hydrocarbons • Soot • Acrolein • Benz (a) pyrene
14	Transformers	• Hydrocarbons

The key potential sources of the contamination mentioned above are found at the five stations (Kazybek Bek Station, Sorbulak Station, Moyinkum Station, Zhana Arna Station, and Zhetygen Station). A detailed list of the locations of the stations and project components are presented in **Appendix A.**

- Waste and wastewater generation: According to the National EIA, during the operational period, the generation of municipal waste is estimated at 5.2 tons per year, while total waste from the territory is projected to be 56.685 tons per year.
- Groundwater use: According to the same National EIA, the groundwater is not directly extracted for use during the operation phase. During operation of the five (5) stations, the Project use imported water supply system.

Based on the potential impacts assessed during the scoping phase of the assessment and subsequent review, the following types of impacts were identified as relevant to the Project:

During Construction:

- **Soil and vegetation fertility:** Soil fertility degradation due to removal of soil-vegetation layer and potential impact from construction activities.
- **Soil and groundwater quality:** Direct soil and/ or groundwater contamination within the project footprint due to potential impact from construction activities (i.e. improper handling of hazardous chemicals, improper management of toxic chemical waste and wastewater generation, improper management of excavation and filling activities).
- **Groundwater quantity:** Potential groundwater drawdown due to earthworks which leads to decreased groundwater baseflow feeding into watercourses.

During Operation:

- **Soil and groundwater quality:** Direct soil and/or groundwater contamination within the project footprint due to operation of trains resulting in diesel oil leakage, improper handling of hazardous chemicals, improper management of toxic chemical waste and wastewater generation.
- **Soil erosion:** Potential adverse geological processes during the operational phase include wind erosion, water erosion, and landslides. There is also a risk of scour caused by culverts and bridges, particularly if culverts concentrate discharges into agricultural land.

6.5.4 ASSESSMENT CRITERIA

The identification of potential sources and receptors has enabled an assessment to be undertaken to evaluate the plausible contaminant linkages and any changes (from baseline conditions) during construction and operational phases of the Project. The likely significance of the risk for each plausible linkage has been assessed and compared to determine beneficial and adverse effects of the Project against baseline conditions.

6.5.4.1 IMPACT CRITERIA

The magnitude of impact to groundwater from the site preparation and construction activities takes into account the likely contamination that will arise from these activities and the potential extent of contamination to the soil and groundwater. The impact magnitude criteria for soil and groundwater are outlined in **Table 6-76.**

TABLE 6-76: IMPACT MAGNITUDE CRITERIA FOR SOIL AND GROUNDWATER

Magnitude	Definitions
Negligible	No potential soil & groundwater impact expected. Abstractions from or discharge to aquifer(s) are unlikely to cause water quality and supply issue.
Small	Localised small-scale contamination in soil and groundwater, with no significant health and/or environment risk. Abstraction or discharge to aquifer(s) may cause small but local changes in water quality in the aquifer system. These can be considered potential short-term localised

Magnitude	Definitions
	effects on groundwater quality which is likely to return to equilibrium conditions within a short timeframe i.e. months.
Medium	Small scale contamination in soil and groundwater with significant health and/or environment risk; or large-scale contamination in soil and groundwater with no significant health and/or environment risk. Abstraction or discharge to aquifer(s) are expected to cause potential localised effects on groundwater quality which are likely to be fairly long lasting and / or give rise to indirect ecological and / or socio-economic impacts.
Large	Large scale contamination in soil and groundwater with significant public health and/or environment risk. Abstraction or discharge to aquifer(s) are expected to cause potentially severe effects on groundwater quantity and quality which are likely to be long-lasting (e.g. years or permanent) and / or give rise to indirect ecological and / or socio-economic impacts.

6.5.4.2 SENSITIVE RECEPTORS

In order to assess the potential impacts of ground contamination, the sensitivity of soil and groundwater is considered. The sensitivity criteria for soil and groundwater are presented in **Table 6-77**.

TABLE 6-77: SENSITIVITY CRITERIA FOR SOIL AND GROUNDWATER

Magnitude	Definitions
Low	No sensitive receptors within Area of Influence (AoI). The groundwater resource supports aquatic habitat or population, but the habitat/population is common/non-diverse/insignificant, and/or The groundwater resource is unimportant in terms of resource use potential (e.g. there are no reasonably foreseeable users and the quality/yield of the groundwater resource may preclude its use).
Medium	Low to moderately sensitive receptors with limited contact to soil and groundwater e.g. high-rise residential, civic buildings and commercial / industrial buildings. Ecologically sensitive receptors within AoI. The groundwater resource supports diverse or susceptible populations of flora and/or fauna, and/or The groundwater resource is an important water supply, and is currently used, but there is capacity and/or adequate opportunity for alternative sources of comparable quality.
High	Highly sensitive receptors with frequent contact to soil and groundwater e.g. low rise residential, recreational and agricultural

Magnitude	Definitions
	Protected ecologically sensitive receptors within AoI. The groundwater resource supports economically important or biologically unique species or provides essential habitat/nutrients to sustain such species, and/or The groundwater resource is wholly relied upon locally, with no suitable technically or economically feasible alternatives, or is important at a regional or transboundary level for water supply or contribution to groundwater dependent ecosystems (e.g. transboundary rivers).

6.5.5 IMPACT ASSESSMENT

6.5.5.1 CONSTRUCTION PHASE

Impacts on soil cover and vegetation fertility

As the railroad alignment will cross agricultural land and open scrub vegetation, excavation and backfilling activities may lead to general decline in soil fertility within the project area, resulting in vegetation loss, and ground profile degradation.

Increased heavy vehicle activity on unpaved roads can cause soil compaction, which may decrease soil permeability and affect vegetation root growth. Vehicles used for clearing and transporting materials may also disrupt soil layers and vegetation, potentially leading to soil erosion.

Additionally, using backfill material of unknown quality and inadequate management of hazardous materials and waste may cause soil contamination that impacts soil fertility.

Embedded Controls

The National EIA outlined following measures to minimise impacts on soil cover in the affected areas and ensure restoration to its original or alternative use. The project includes specific measures for the removal, transportation, and storage of the fertile soil layer and overburden, as well as technical and biological reclamation.

- Removal and storage of fertile soil:
  - Ensure strict monitoring during the removal of the fertile soil layer across the site.
  - Store the removed soil in designated areas for later use in landscaping.
  - Before excavation, the upper fertile soil layer should be removed and stored nearby. After backfilling, the soil should be levelled over the filled trenches.
- Site Cleanliness:
  - Regular cleaning of the construction and installation site will be conducted.
  - Workplaces will be equipped with containers for household and construction waste.
  - Clearing littered areas of all waste.
  - Ensure proper disposal, storage, and transportation of household and technological waste.
- Roads and Accessibility:
  - Temporary roads and access points will be constructed prior to work commencement, adhering to guidelines to prevent damage to trees and shrubs.

    - Restrict the movement of construction equipment and vehicles to access and internal roads only.
    - Utilisation of vehicles with low tire pressure.
- Fuelling and Equipment Maintenance:
    - Refuelling of construction equipment will be conducted at stationary fuelling points.
    - Construction machinery will undergo regular technical inspections and repairs to prevent soil contamination from fuel and lubricants.
    - Operate vehicles and machinery in good technical condition to reduce pollutant emissions and prevent environmental degradation.
- Rehabilitation, preservation and restoration:
    - Rehabilitating disturbed lands and adjacent plots impacted by construction activities.
    - Restoring soil and vegetation through the creation of herbaceous communities, which will compensate for environmental damage caused by vegetation loss, soil disturbance, habitat disruption, hydrological changes, and pollution.
    - Reclamation will ensure soil contamination is eliminated, and stored soil will be reused for project needs.

Impact Magnitude

Heavy vehicles movement are likely to be limited to existing road network and thus the impacts are not anticipated to be widespread.

The total earthworks volume is estimated up to 6,221,608 m^3 and considering the large volume, excavation and backfilling may alter local topography, soil structure and quality significantly, leading to potential loss of soil fertility. Quarrying for construction materials may result in localised depletion of soil resources and cause significant environmental risk, though it is limited to predefined quarries.

Improper management of chemical, waste and wastewater may also lead to soil and groundwater contamination and reduced land fertility.

Considering the above, the impact magnitude of the impacts on soil cover and vegetation fertility during construction is considered **Medium**. Soil fertility will be preserved through careful handling, and the vegetation loss will be temporary, as restoration is planned.

Impact Significance

The impacts will be confined to specific areas of construction, access routes, and material quarries, which is not considered sensitive and thus, the receptor sensitivity is considered **Low**, therefore the impact significance is evaluated as **Minor**.

During construction, no significant long-term impacts are anticipated. Proper management and reclamation activities will mitigate environmental risks and restore the soil cover effectively.

Mitigation Measures

As the pre-mitigated impact is Minor, no additional measures are required.

Summary

The impact significance for soil cover and vegetation fertility is summarised in **Table 6-78**.

TABLE 6-78: IMPACT SIGNIFICANCE OF CONSTRUCTION ACTIVITIES ON SOIL COVER AND VEGETATION FERTILITY

Category	Impact before Mitigation	Residual Impact
Nature	Negative	
Type	Direct	
Duration	Short-term	
Extent	Local	
Scale	Impacts are confined to specific areas of construction, access routes, and material quarries.	
Frequency	During construction phase only	
Significance	**Minor**	N/A

Impact Significance

Considering the project area are nearby various farmland and open area, which are considered sensitive the receptor sensitivity is considered **Medium**, therefore the Pre-Likelihood Impact Significance is evaluated as **Minor**.

The likelihood of unplanned event such as leaks and improper waste management are assessed to be **Unlikely.** There does not appear to be any specific reports in the past 10 years about soil and groundwater contamination directly attributed to the operations of KTZ or railway system in Kazakhstan in general. The Post-Likelihood Impact Significance is evaluated as **Minor.**

The implementation of embedded control ensures that the likelihood of adverse effects is substantially reduced. Impacts are localized, temporary, and reversible, with no significant long-term degradation expected.

These measures collectively safeguard the soil and groundwater quality, ensuring sustainable environmental management throughout the project lifecycle.

Impacts on soil and groundwater quality

During construction, soil and groundwater quality may be directly impacted due to potential construction activities i.e. improper management of hazardous chemicals, waste and wastewater, as well as potential contamination due to backfilling activities. No baseline soil and groundwater quality information as well as the quality of backfill material source are available to understand pre-existing conditions.

Embedded Controls

The National EIA and industrial environment control program outlined following measures to minimise impacts on soil and groundwater quality degradation:

- **Compliance with environmental legislation:**
  - Subsoil use must align with the environmental legislation of the Republic of Kazakhstan.
  - Adhere to national laws to prevent harmful anthropogenic processes.

- Protection measures should address risks from natural factors like flooding and fires.
- Compliance with rules related to environmental protection.
- Compliance with the conditions of environmental and other permits.

- **Mitigation measures for construction activities:**
  - Irrigation and Dust Control: Use irrigation as needed to control dust from open soil and loose materials.
  - Excavated Materials Management: Excavated soil, garbage, and sludge will be transported to designated disposal sites. Excess soil will be used for backfilling or removed to approved locations.
  - Transport Best Practices: Ensure that soil, debris, and sludge are securely covered during transport to prevent spillage.
- **Waste handling and storage:**
  - Construction Waste: Temporary storage of construction waste on-site before disposal or reuse. Excess soil will be removed to designated areas such as ravines or gullies.
  - Solid Domestic Waste: Store waste (paper, plastic, food, etc.) in designated containers on hard-surface areas. Waste will be regularly removed and transported to landfill sites. Littering, burning, or burying waste on-site is prohibited.
  - Fuel and Equipment Maintenance: Ensure that equipment is in good condition to prevent leaks of fuel and lubricants. Faulty equipment should not be used.
  - Washing of Equipment: Washing of vehicles and equipment on-site is strictly prohibited.
  - Wastewater: no industrial or domestic wastewater to be discharged into surface or groundwater sources, minimising the risk of contamination.
- **Soil Conservation and Land Management:**
  - Post-Construction Cleanup: Ensure the site is cleared of construction and household waste after project completion.

Impact Magnitude

Polluted soil and groundwater may pose a risk to groundwater contamination, especially if hazardous substances, like oils and chemicals, are improperly disposed of. The discharge of wastewater and uncontrolled surface runoff could alter the natural flow of water bodies, leading to erosion, sedimentation, and changes in water quality, which could significantly impact local ecosystems. However, with the embedded controls in place, the impact is not expected to be significant. The overall magnitude of the impact is considered **Small**.

Mitigation Measures

Considering the large volume of earthworks involved, the project should undertake visual observation (noting that not every contamination is visible such as heavy metal) and conduct sampling and laboratory analysis of imported fill material if red flags are found to minimise potential contamination risks.

Summary

The impact significance for soil and groundwater quality is summarised in **Table 6-79.**

TABLE 6-79: IMPACT SIGNIFICANCE OF CONSTRUCTION ACTIVITIES ON SOIL AND GROUNDWATER QUALITY

Category	Impact before Mitigation	Residual Impact
Nature	Negative	
Type	Direct	
Duration	Short-term to Long-term	
Extent	Local with potential of migration	
Scale	Limited to railway corridor and immediate surroundings	
Frequency	During construction phase only	
Significance	**Minor**	N/A

Impacts on groundwater quantity

Total consumption of domestic water for the construction activities is 18,323 m^3 and technical and industrial water needs is 73,731 m^3. Total volume of water required to be extracted is approximately 94,054 m^3.

Embedded Controls

To ensure reliable supply, stations for first and second lifting are planned, with differing capacities and dimensions to suit site-specific requirements. This plan ensures sufficient water availability throughout the construction phase, with minimal disruption to local groundwater resources.

Impact Magnitude

According to the groundwater extraction volume, the impact magnitude on the decreasing of groundwater quantity is considered **Small**.

The geological study does not provide specific value of total groundwater volume available, however the project area has favourable conditions for groundwater accumulation and distribution.

The volume of water required for construction can likely be accommodated by local groundwater availability, especially given the intermittent nature of use and localised sourcing. The use of existing wells minimises additional strain.

Impact Significance

The groundwater resources within the study area serve as an important water supply for the surrounding region and are currently in use. Therefore, the receptor sensitivity is considered **Medium**, and the impact significance is evaluated as **Minor**.

The impact is limited to the construction phase. Groundwater abstraction affects only wells near the project route. The abstraction will not significantly affect groundwater recharge rates or long-term availability given the moderate withdrawal volumes.

Mitigation Measures

No additional mitigation measure is required.

Summary

The impact significance for groundwater quantity is summarised in **Table 6-80.**

TABLE 6-80: IMPACT SIGNIFICANCE OF CONSTRUCTION ACTIVITIES ON GROUNDWATER QUANTITY

Category	**Impact before Mitigation**	**Residual Impact**
Nature	Negative	
Type	Direct	
Duration	Short-term	
Extent	Local	
Scale	Limited to railway corridor and immediate surroundings	
Frequency	During construction phase only	
Significance	**Minor**	N/A

6.5.5.2 OPERATIONAL PHASE

Impacts on soil and groundwater quality

During operation phase, there is a potential for direct soil and/or groundwater contamination within the project footprint due to diesel oil leakage from station operations, improper handling of hazardous chemicals, inadequate management of toxic chemical waste, and wastewater generation.

According to the National EIA, groundwater is not directly extracted for use during the operation phase. During operation of the five (5) stations, the Project uses imported water supply system.

Embedded Controls

The following measures are recommended to minimise impacts on soil and groundwater quality degradation during operation phase:

- **Compliance with Environmental Legislation:**
    - Land Use Compliance: Avoid encroachment on water fund lands.
    - Environmental Compliance: Adhere to directives from environmental authorities to reduce water consumption and pollutant discharge.
    - Adhere to national laws to prevent harmful anthropogenic processes.
    - Protection measures should address risks from natural factors like flooding and fires.
- **Waste Handling and Storage:**
    - Wastewater Management: Prohibit industrial and stormwater discharge into surface water bodies.
    - Waste Management: Enforce protocols for the proper disposal of chemical waste and wastewater.
    - Sanitation: Maintain proper sanitary conditions at the construction and operational sites.
- **Contamination prevention:**

- Equipment Maintenance: Ensure all machinery and equipment are in good working condition to prevent leaks and spills.
- Hazardous Material Management: Implement strict controls on hazardous materials to prevent contamination.
- Containment Systems: Install spill containment and runoff management structures to mitigate accidental pollution.
- Monitoring: Regularly monitor soil and water quality along the railway corridor.
- The availability and technical condition of equipment for the localisation and elimination of the consequences of man-made accidents.

Impact Magnitude

With these mitigation measures in place, the magnitude of the impact is considered **Small**. The risks of contamination are minimised through effective controls and monitoring, maintaining the quality of soil and groundwater within acceptable limits.

Impact Significance

The railway intersect wide range of land use includes farmland and open area therefor the receptor sensitivity is considered **Medium**, the Pre-Likelihood Impact Significance is evaluated as **Minor**.

The likelihood of these unplanned events is assessed to be **Unlikely.** There does not appear to be any specific reports in the past 10 years about soil and groundwater contamination directly attributed to the operations of KTZ or railway system in Kazakhstan in general. The Post-Likelihood Impact Significance is evaluated as **Minor**

The implementation of embedded control ensures that the likelihood of adverse effects is substantially reduced. Impacts are localised, temporary, and reversible, with no significant long-term degradation expected.

Mitigation Measures

No additional mitigation measure is required.

Summary

The impact significance for soil and groundwater quality during operation phase is summarised in **Table 6-81**.

TABLE 6-81: IMPACT SIGNIFICANCE OF OPERATION ACTIVITIES ON SOIL AND GROUNDWATER QUALITY

Category	Impact before Mitigation	Residual Impact
Nature	Negative	
Type	Direct	
Duration	Long-term	
Extent	Local	
Scale	Limited to railway corridor and immediate surroundings	

Category	Impact before Mitigation	Residual Impact
Frequency	Occasional. Linked to incidents such as accidents, spills, or inadequate waste management during maintenance activities.	
Significance	**Minor**	N/A

Impacts on Soil Erosion

The railway alignment crosses a geologically diverse region within the Ili Depression, characterized by dynamic landforms and processes such as erosion, landslides, mudflows, and seismic deformations. Seasonal variations, including flooding from mountain-fed rivers, further influence soil stability.

On the operation phase, there is potential risk of scour or erosion of soil or sediment around the foundation of bridges and culvert under the railway. This can occur when water flows through these structures, eroding soil around them.

Embedded Controls

The Project design has considered the relevant national regulatory requirements related to seismic design risk assessment and soil erosion and the findings of the site-specific geological investigation study.

Impact Magnitude

Given the interaction of train and station operations to soils the potential impact could range from small to medium. However, with embedded controls such as site-specific geology assessments, soil stabilization techniques, and engineering solutions designed for seismic resilience, the impact magnitude is assessed as **Small**.

Impact Significance

The receptor sensitivity is considered **Medium**, therefore the Impact Significance is evaluated as **Minor**.

Summary

The impact significance on seismic risk impact during construction phase is summarised in **Table 6-82**.

TABLE 6-82: IMPACT SIGNIFICANCE OF CONSTRUCTION ACTIVITIES ON SEISMIC RISK

Category	Impact before Mitigation	Residual Impact
Nature	Negative	
Type	Indirect	
Duration	Short-term	
Extent	Local	
Scale	Limited to railway corridor and immediate surroundings	
Frequency	Occasional. Linked to natural seismic events.	
Significance	**Minor**	N/A

6.6 BIODIVERSITY

6.6.1 APPLICABLE REFERENCE FRAMEWORK

Applicable laws, directives, policy and guidance for biodiversity impacts are outlined in **Table 6-83.**

TABLE 6-83: BIODIVERSITY APPLICABLE REGULATIONS AND GUIDELINES

Title	Year
Law	
Environmental Code of the Republic of Kazakhstan No. 400-VI ZRK	2024
The Ecological Code of Kazakhstan (#400-VI, adopted 2 January 2021, with the last amendment on 21 May 2024)	2024
Law of the Republic of Kazakhstan about Protection, Reproduction and Use of Fauna No. 593-II	2004
Law of the Republic of Kazakhstan on Specially Protected Natural Areas No. 175	2006
Policy	
IFC Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	2012
IFC Environmental and Social Performance Standards	2012
IFC Environmental, Health, and Safety Guidelines for Railways	2007
Guidance	
RSI "Almaty Regional Territorial Inspectorate of Forestry and Wildlife of the Committee of Forestry and Wildlife of the Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan" No20/14090[133]	2022
Model Rules for the Creation, Maintenance, and Protection of Green Spaces in Settlements, approved under Order No. 62 by the Minister of Ecology and Natural Resources of Kazakhstan	2023
Kazakhstan has been a Party to the Convention on the Conservation of Migratory Species (CMS) since 1 May 2006, and has signed several MOUs demonstrating its commitment to conserving migratory wildlife. These include agreements for the Siberian Crane (1998), Slender-billed Curlew (1994), Bukhara Deer (2002), Saiga Antelope (2006), and Birds of Prey (2024)	2006

6.6.2 EARLY-STAGE CONDITIONS

The biodiversity approach for the Supplementary ESIA was structured to systematically assess baseline conditions, potential impacts, and biodiversity values within the Project's AoI. This approach builds on the findings of the National EIA, floral inventory surveys, natural habitat mapping, and desk-based screening conducted prior to primary surveys. The initial work included:

[133] There are no migration routes for rare species of animals listed in the Red Book of Kazakhstan.

- National EIA Findings: Baseline and impact analysis to identify key ecological considerations.
- Floral Inventory (2024): Assessment of green spaces and vegetation type along the railway line that will be impacted due to construction activities.
- Natural Habitat Mapping: Based on IFC's March 2024 site visit, potential natural habitats along the bypass route were identified. This mapping categorised three potential habitats: riparian, steppe grassland, and riparian/steppe mix.
- Desktop Analysis: Biodiversity databases and peer-reviewed literature were utilised to assess species presence/absence, habitat preferences, and ecological sensitivities. Key resources included iBAT reports, IUCN Red List, eBird, iNaturalist, GBIF, FishBase, and local field guides.

Based on these, a Project AoI was delineated, and the survey methodology was developed to focus on specific taxa potentially using the AoI. An ecological survey was conducted from 23 to 28 September 2024 to establish an ecological baseline and identify any sensitive ecological receptors within the AoI of the Project.

The National EIA (InTech, 2023) provides limited detail on biodiversity values within the project's right-of-way (RoW). Specifically, baseline information on species utilising the project area is absent. Section 17.2 of the National EIA summarises biodiversity impacts and mitigation measures with a primary focus on green space assessment and landscaping plans, as outlined below:

- **Observations and Existing Conditions**
- Based on green space inspection reports dated 10 and 15 June 2023, 44,572 green plantations[134] and 16,250 m² of wild shoots[135] were documented along the railway bypass through Talgar, Ili, Karasai, and Zhambyl districts in Almaty.
  - The area's vegetation and fauna are described as anthropogenically transformed. The construction zone lacks significant natural vegetation, instead hosting meadow vegetation on man-made deposits.
  - The National EIA identifies the absence of:
    - Permanent bird and animal habitats
    - Relict plantations
    - Rare, relict, or endemic plant species listed in the Red Data Book of Kazakhstan.
  - The site is deemed of low biodiversity value for flora and fauna at present.
- **Mitigation Measures Outlined**
  - Landscaping recommendations: post-construction landscaping involves planting poplar, lilac, and golden currant species at various stations, with detailed numbers provided for Zhana Arna, Kazybek Bek, and Sorbulak stations. It is recommended that native species of the above-mentioned species be considered for planting for example native poplar species like *Populus pruinos, Populus macrocarpa* etc. and limit, where possible, planting non-native species of lilacs and golden currant (like *Ribes aureum*). Landscaping is also planned for the Sanitary Protection Zone (SPZ), with specific

[134] Green plantations typically consist of cultivated trees and shrubs that are intentionally planted for various reasons especially as snow breaks.
[135] Wild shoots refer to naturally occurring vegetation.

guidelines for creating mixed tree and shrub plantings that prioritise biological stability and aesthetic qualities. Key measures include:

- Ensuring at least 60% landscaping[136] within SPZs. Planned landscaping after construction completion includes:
    - Zhana Arna Station: 80 poplars, 128 lilacs, 28 golden currants.
    - Kazybek Bek Station: 37 poplars, 202 lilacs, 22 golden currants.
    - Unnamed Site: 44 poplars, 68 lilacs.
    - Sorbulak Station: 44 poplars, 64 lilacs, 28 golden currants.
    - Additional Site: 114 poplars, 128 lilacs, 28 golden currants.
  - Preserving existing green spaces wherever possible.
  - Contracting specialised organisations for maintenance, sanitary pruning, and planting.

Additionally, the National EIA references several measures aimed at pollution control, erosion prevention that are relevant for mitigating biodiversity impacts and are summarised as follows:

- Construction and installation works must be confined to the designated right-of-way (RoW) to avoid disturbances to surrounding vegetation and wildlife habitats. The movement of machinery and storage of materials outside the approved RoW must be strictly prohibited.
- Measures to prevent soil erosion, gully formation, and landslides should be implemented in accordance with design specifications to minimise sedimentation and maintain ecological stability.
- Sealed containers must be used for transporting bulk materials like cement and mortar to eliminate dust dispersion. Open storage and handling of dusty substances should be avoided by using enclosed systems or specialised vehicles. Fuels and lubricants should only be drained at designated, equipped locations to prevent soil and water contamination.
- Special installations should be used for heating materials to minimise chemical runoff and protect nearby ecosystems.
- Vegetation restoration should be prioritised post-construction. Restoration efforts must aim to reinstate natural vegetation cover with a focus on replanting native species.
- Heavy equipment that generates excessive vibrations should be installed on isolated foundations to minimise disturbance. Soundproof barriers should be used around high-noise machinery.

In addition to the National EIA, a floral inventory was conducted as part of the 'Outcomes Inventory and Survey of Green Spaces' in 2024. The survey covered the Karasai, Zhambyl, Iliy, and Talgar districts. Key findings and recommendations include:

- A total of 12,541 trees and shrubs were identified across the surveyed areas, including species such as Squat Elm (*Ulmus pumila*), Saksaul (*Haloxylon* sp.), Loch (*Elaeagnus* sp.), Comb branched (*Tamarix ramosissima*), Chingil (*Halimodendron* sp.), Zhuzgun (*Calligonum* sp.).

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[136] In accordance with the SP "Sanitary and Epidemiological Requirements for Sanitary Protection Zones of Facilities That Are Objects of Impact on the Environment and Human Health" dated 11 January 2022 No KR DSM-2 for facilities of hazard class IV, the maximum landscaping in the SPZ is provided - at least 60% of the area, with the mandatory organization of a strip of tree and shrub plantations from the side of residential development.

- A total of 12,220 trees and shrubs, primarily plantation species with low biodiversity value functioning as snow-breaks, are recommended for clear-cutting (forced demolition), distributed as follows:
  - Zhambyl District: 827 trees.
  - Karasai District: 892 trees, with 321 Zhuzgun shrubs recommended for transplanting.
  - Iliy District: 9,920 trees.
  - Talgar District: 802 trees.
- Compensatory Planting Requirements[137]:
  - As per the Model Rules for the Creation, Maintenance, and Protection of Green Spaces (Order No. 62, 23 February 2023), compensatory planting is required at a tenfold rate for trees and shrubs removed.
  - Total compensatory planting volume: 125,410 trees and shrubs. Breakdown:
    - Zhambyl District: 8,270 (6,390 trees and 1,880 shrubs).
    - Karasai District: 8,920 (2,140 trees and 6,780 shrubs).
    - Iliy District: 100,200 (88,060 trees and 12,140 shrubs).
    - Talgar District: 8,020 trees.
    - Shrubs such as Zhuzgun (321 pcs.) will be planted along the railway strip, with a 50-meter setback from the rails.
  - Compensatory Planting Specifications:
    - Tree seedlings must have a trunk diameter of at least 3cm at 1.3m height.
    - If planted seedlings die, replanting is required, along with maintenance and protection for three years to ensure survival. Though the National EIA does not detail on the monitoring plan, it is recommended that a monitoring process must be implemented to ensure the survival of compensatory plantings, with maintenance and protection measures carried biannually out over the three-year period. Survival Rate may be estimated by visually counting live trees within sample plots and comparing them with the initial planting numbers. Health assessments may include inspecting leaves for discoloration or defoliation, checking for pest damage, bark condition, and root exposure, using a simple rating scale (healthy, moderate stress, severe stress) for standardised observations. The responsibility for monitoring should be assigned to the O&M contractors in collaboration with the hired ecologist. Clear survival benchmarks should be set, such as 80% survival over the three-year period. In the event that the planted seedlings do not survive, a replacement plan should be developed in consultation with the relevant regulatory authority. Non-surviving trees should be replaced within the first planting cycle to ensure the success of the compensatory planting
    - In cases where space for compensatory planting is unavailable within a 1km radius, the authorised body will designate an alternative site on public lands, involving a landscaping organisation.

[137] Please note that the compensation of trees cutting down from stands which act as snow-breaks could be considered commercial and are not for complying for compensating for loss of natural habitat as per IFC PS6

- For unauthorised felling, compensatory planting will also follow the tenfold rule within the specified area.

Further, IFC conducted site visits in March 2024 along the entire bypass route and identified areas of potential natural habitat. Locations visited included the areas of overlap between the bypass route and the likely KBA boundary, wetland crossings and other patches of steppe habitat. Focus of the site visit was not to identify species. Refined habitat mapping was produced based on the outcomes of the site visit, the natural habitats identified are- riparian habitat, steppe grassland habitat and a mix of riparian/steppe habitat.

6.6.2.1 SCOPE OF ASSESSMENT

The Supplementary ESIA biodiversity assessment was conducted with the following objectives:

- Identification of any sensitive habitats or forest land falling within the proposed Project site location, RoW and adjoining areas;
- Classification of flora for any endangered, protected or endemic floral species prevailing in the study area based on the field surveys;
- Identification of fauna (specifically birds, mammals, reptiles and amphibians) based on direct sightings, calls, pugmarks, droppings, nests, etc.;
- Identification and classification of any species recognized as threatened (in accordance with International Union for the Conservation of Nature [IUCN] Red List Version 2024) and in accordance with the categories of Red Data Book of Kazakhstan;
- Identification of areas which are important or sensitive for ecological reasons including their breeding, nesting, foraging, resting, over-wintering including wildlife migratory corridors/avian migratory routes; and
- Identification of areas protected under international conventions, national or local legislation and those recognized nationally and internationally for their ecological, landscape, cultural or other related value.

6.6.2.2 DESK BASED ASSESSMENT

In addition to primary surveys during the site visit for the Supplementary ESIA, secondary data for the project site was collected from information available for Sorbulak Lake Complex, Almaty region/Almaty Oblast and other relevant published scientific literature.

The project site location and immediate surroundings was also screened for IUCN listed threatened species (CR, EN, and VU Species). Databases such as IBAT (Integrated Biodiversity Assessment tools), and citizen science platforms such as ebird, iNaturalist, GBIF (Global Biodiversity Information Facility) were used to understand the presence or absence of the potential Critical Habitat (CH) trigger species and their habitat. A list of references is presented in **Table 6-84.**

TABLE 6-84: DATA SOURCES FOR BIODIVERSITY ASSESSMENT

No.	Source	Purpose	Reference/Link
1	Red Data Book of Kazakhstan	The Red Data Book of Kazakhstan is an official national document that provides data on the current distribution, number, biological features along with current and proposed conservation measures for 128 species and subspecies of vertebrates: fishes (18), amphibians (3), reptiles (10), birds (57) and mammals (40). The book includes a brief description, colour picture along with a map indicating the distribution of each species within Kazakhstan. It is aimed to support their conservation.	The Red Data Book of the Republic of Kazakhstan. 4th edition, revised and updated. Volume I.: Animals; Part 1: Vertebrates. (authors' collective) Almaty, "DPS", 2010.–324 pp. ISBN 9965-32-738-6
2	IUCN Red List for Threatened Species Online Version [2024-2]	The IUCN Red List provides a list of threatened species by classifying them from Least Concern (LC) to Critically Endangered (CR) through an understanding of their global distribution, population numbers, and trends in population decline and stresses on the species. As part of the classification, the global distribution and habitat preference of the species is given.	IUCN Red List of Threatened Species
3	iBAT (Integrated Biodiversity Assessment Tool)	IBAT is a multi- institutional program of work involving BirdLife International, Conservation International, IUCN, and UNEP-WCMC. IBAT reports were generated for the project study area to understand the presence of IUCN listed Threatened species in the area. Areas of conservation significance such as Protected areas, IBAs and KBAs falling within the 50 km radius of Project site were also included in this assessment.	Integrated Biodiversity Assessment Tool (IBAT)
4	BirdLife Data Zone	BirdLife International maintains a database on Endemic Bird Areas (EBA) and Important Bird Areas (IBAs) that provides a list of species found in these designated areas, sensitivities of these habitats and identifies migratory, congregatory and threatened species in the area.	http://datazone.birdlife.org/home

No.	Source	Purpose	Reference/Link
5	ebird.org	ebird.org provides a geo-referenced list of identified bird species in each area. The ebird.org database was used to confirm presence/absence of bird species found in the Project landscape.	https://ebird.org/ho me
6	Online database of Conservation International and Critical Ecosystem Partnership Fund	These data bases help in identifying and provide information on Global Biodiversity Hotspots.	https://www.conservation.org/ https://www.cepf.net/
7	UNESCO World Heritage Site	This provides an insight into the network of Biosphere Reserve and Natural World Heritage Sites.	www.whc.unesco.org
8	Alliance for Zero Extinction Sites	Guidance to identify proximity to any declared Alliance for Zero Extinction Sites.	https://zeroextinction.org/
9	Global Biodiversity Information Facility	It is an international open-access platform that aggregates biodiversity data, providing free access to species occurrence records and specimen collections worldwide. Launched in 2001, GBIF Collaborates with institutions to support biodiversity research, conservation planning, and policy-making by offering data critical for mapping species distributions and studying ecological changes.	https://www.gbif.org/
10	iNaturalist	iNaturalist is a citizen science platform for species identification and a tool for recording organism occurrences. It allows users to document their own observations, receive assistance with species identification, collaborate with others to gather data, and access the extensive collection of observational data contributed by the iNaturalist community.	https://www.inaturalist.org/
11	Peer-reviewed secondary -literature	Online peer-reviewed secondary literature for the project area landscape were used to understand the presence/absence of priority species and determine habitats of conservation importance.	-

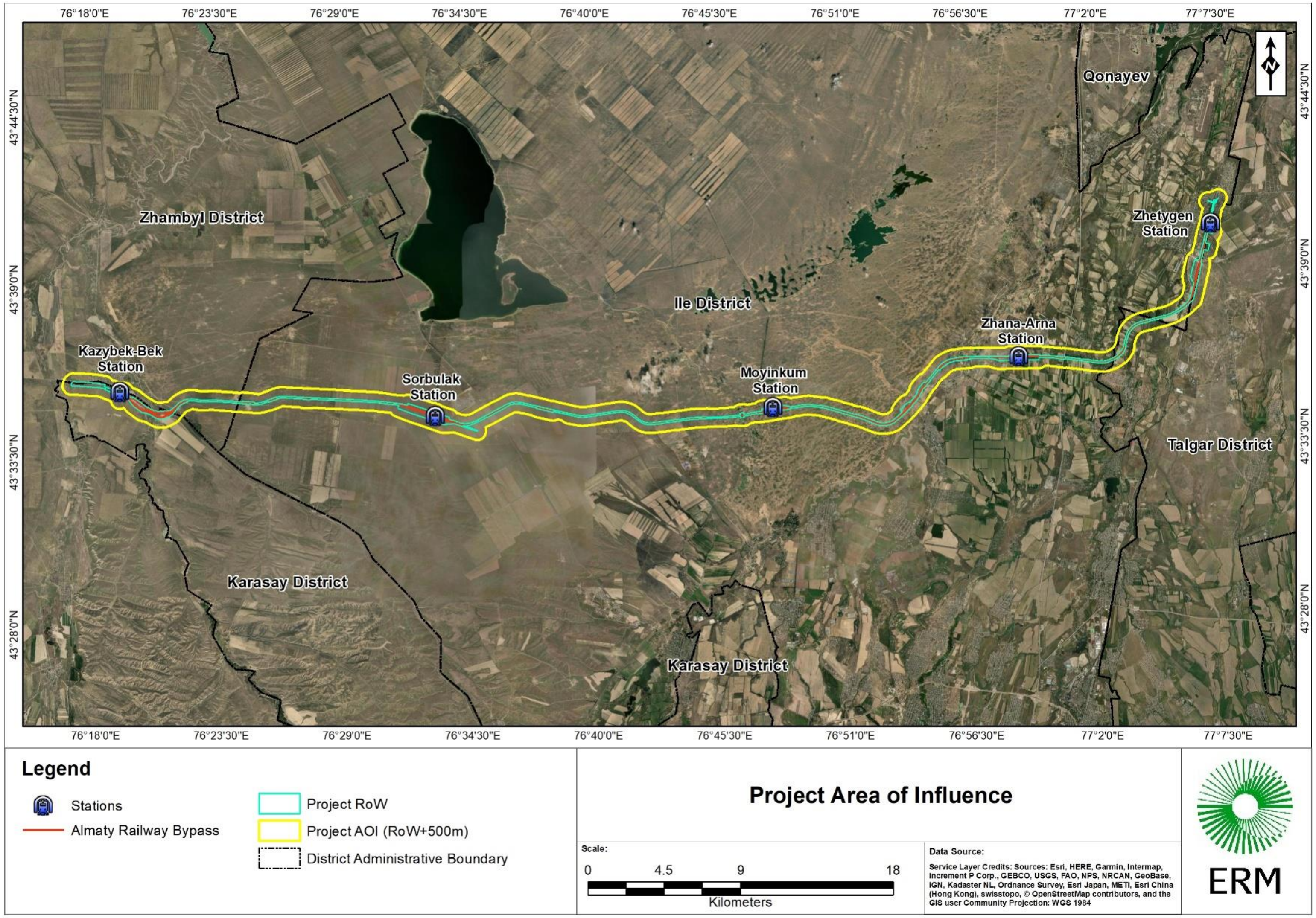
Professional judgement guided if species identified from the above sources were found in the AoI or within the Project footprint. Desk-based assessment was also used to identify habitat contiguity, habitats of conservation significance (e.g. Protected Areas) and potential hotspots for migratory and congregatory species (e.g. waterbodies).

6.6.2.3 DELINEATED AREA OF INFLUENCE

The Project's AoI has been delineated as the project footprint, along with an established Construction RoW, and an additional 500m on either side of the RoW.

The above AoI was established based on sensitivities identified during desktop review, assessment of habitat availability and contiguity, potential priority biodiversity values, and empirical data from multiple linear infrastructure ecological assessments conducted by ERM in the last few years. The ecological AoI is illustrated on **Figure 6-27**.

FIGURE 6-27: ECOLOGICAL AREA OF INFLUENCE (AOI)



6.6.2.4 PRIMARY SURVEY METHODOLOGY

The primary survey comprised reconnaissance of the project AoI to understand the type of habitat, the vegetation type of these habitats and any unique geographical features. The site assessment also included visiting Key Biodiversity Areas in proximity to the railway alignment particularly the Sorbulak Lake Complex.

During the site assessment consultations were carried out with subject matter experts from Association for the Conservation of Biodiversity in Kazakhstan (ACBK), BirdLife International, governmental agencies (Regional Committee of Wildlife and Forestry) and independent researchers to understand the distribution and behaviour of the species identified in the region.

Habitat Surveys

The various habitats were identified using Google Earth Pro to determine the types and extent of habitats in the AoI of the project site. These habitats were marked and visited during the site reconnaissance to identify the quality and level of disturbance at these habitat locations.

Additionally, the natural habitats that were previously identified and mapped by IFC, were visited and validated through field observations.

Floral Survey

The floral diversity of the study area was recorded by visual observations during the site visit and review of scientific publications available in the public domain.

Faunal Surveys

Faunal species were recorded based on direct sightings, indirect evidence (dung, droppings, scat, pugmarks, scratch signs, burrow, nests) and consultations with local subject matter experts. The species occurring within the study area were surveyed using the following methodologies:

- **Waterbody Survey:** Waterbodies within the AoI and additionally the Sorbulak Lake System were surveyed during early morning and evening hours to monitor bird activity. These visits aimed to establish a comprehensive baseline of waterbird populations in the AoI. Special attention was given to recording migratory species. In addition, presence of herpetofauna (amphibians and reptiles) along the shaded ledges of water bodies were recorded. Waterbody survey locations are shown in **Figure 6-28.**
- **Point count Survey:** Points along the railway alignment were marked using GIS approximately 7km apart. Point counts were also conducted to cover various habitat types including agriculture land, semi-desert and steppe/pastureland. The point survey included approaching the potential site and recording all birds in a 15-minute period. Observers walked for approximately 500m in the direction of suitable habitat and recorded the flora, birds and mammals. An additional 10 minutes were spent to record reptiles. Point count survey locations are shown in **Figure 6-29**.

- **Line Transect:** Faunal diversity was also recorded through line transects[138]. Seven (7) transects of length 1km were surveyed covering major habitats/land use found within the study area. Transects focused on recording the activities of birds, in identifying sites of ecological significance to birds, such as sites of feeding, breeding, and nesting, and roosting. In addition, mammal species were recorded through direct observations and through indirect methods such as pellets, tracks, paw marks and scat. Species were then identified using standard literature. The surveys were undertaken between 0630-1030 hrs and 1500-1830 hrs. The details of transects and their locations are given in **Table 6-85** and **Figure 6-30**.

[138] A transect survey for birds is a systematic method used to estimate the abundance and distribution of bird species within a specific area. This technique involves selecting a linear path, or transect, across the habitat of interest, which is then walked or traversed by observers who record all birds seen or heard within a predetermined distance from the transect line. The transect survey allows for the collection of standardized data, making it possible to compare bird populations across different areas and time periods. This method is particularly useful in assessing the impact of environmental changes or conservation efforts on bird communities. The data gathered from transect surveys provide valuable insights into species diversity, population trends, and habitat preferences, informing conservation strategies and aiding in the management of bird populations.

FIGURE 6-28: WATERBODY SURVEY LOCATIONS

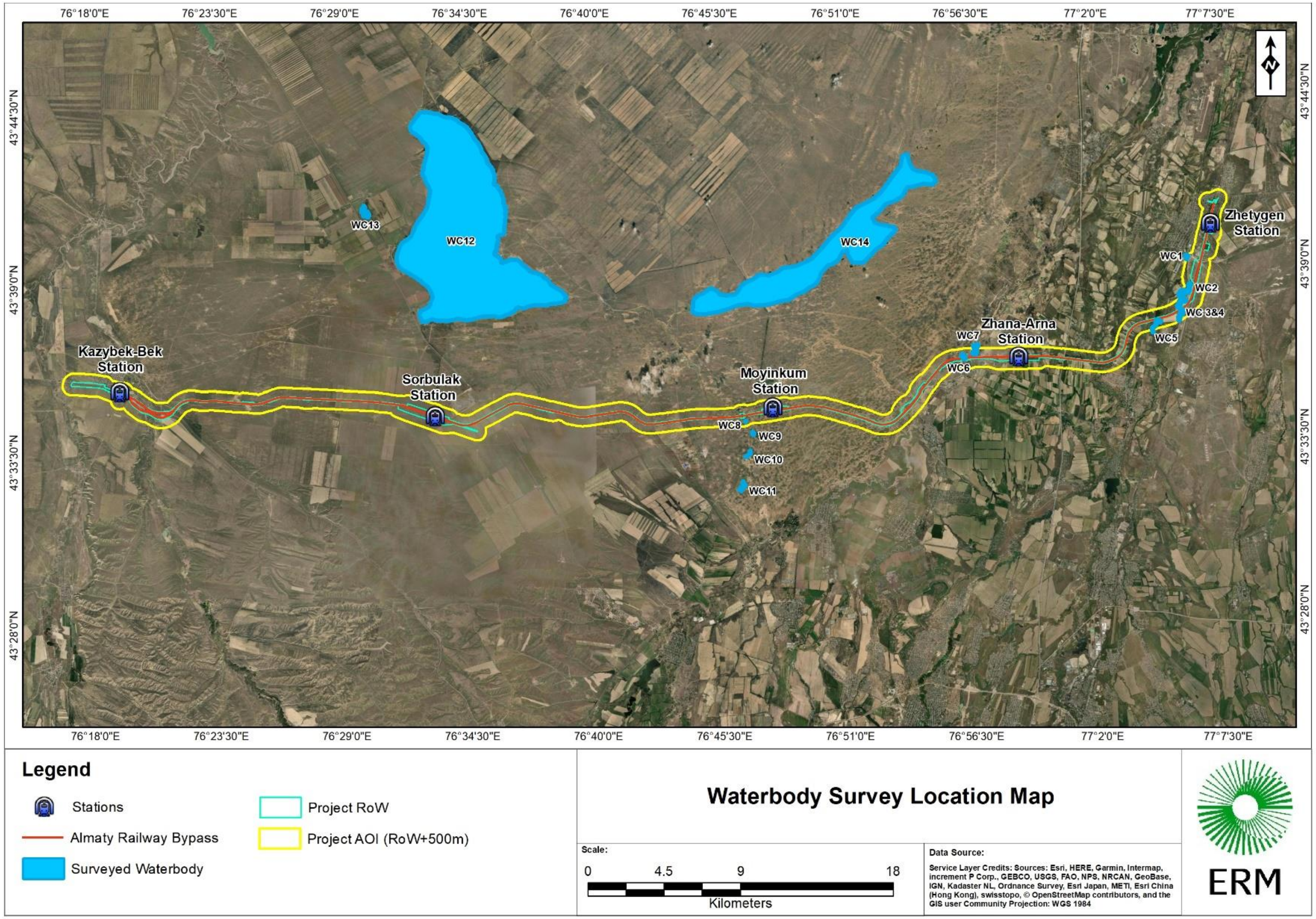


FIGURE 6-29: POINT COUNT SURVEY LOCATIONS

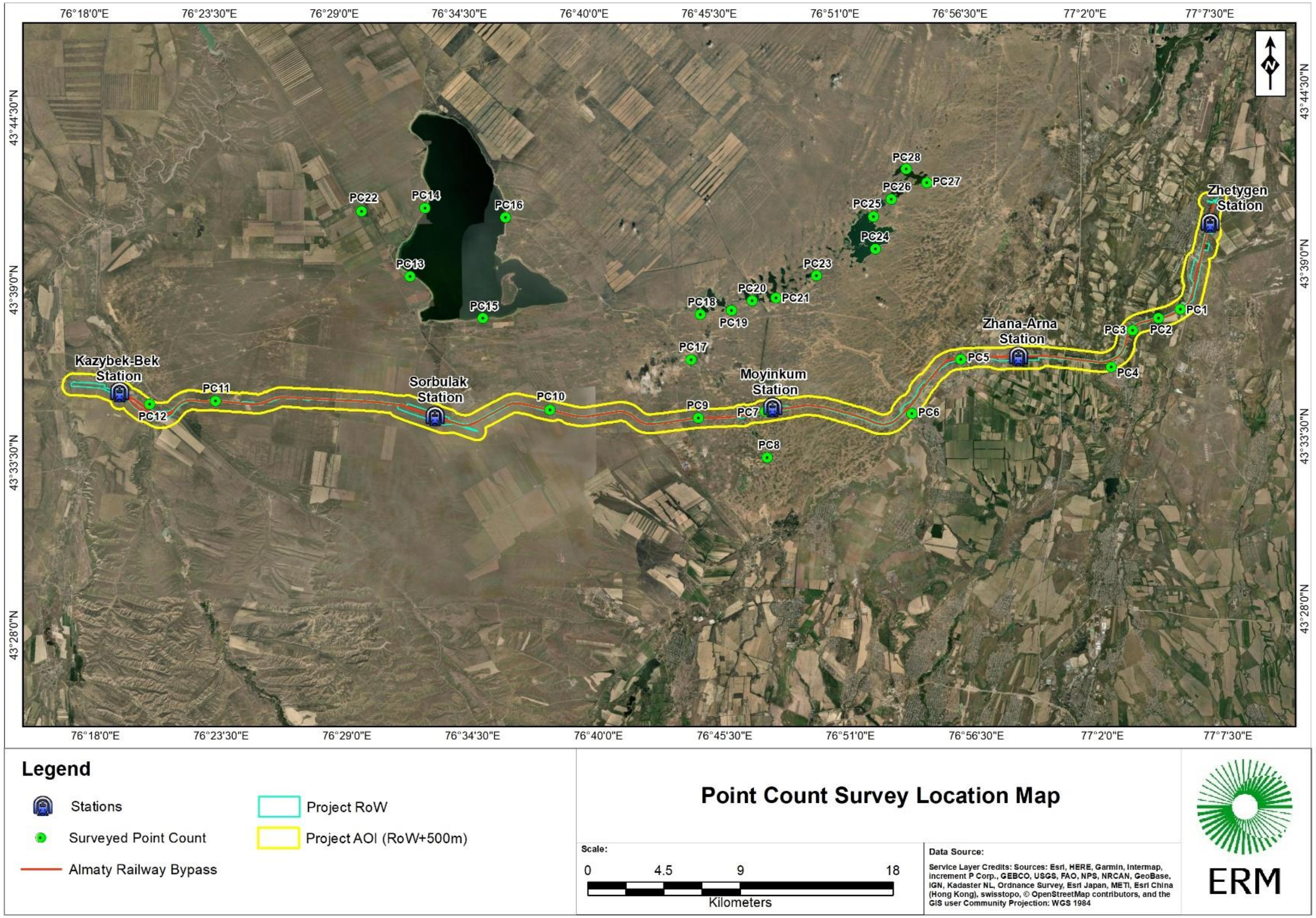


FIGURE 6-30: LINE TRANSECT SURVEY LOCATIONS

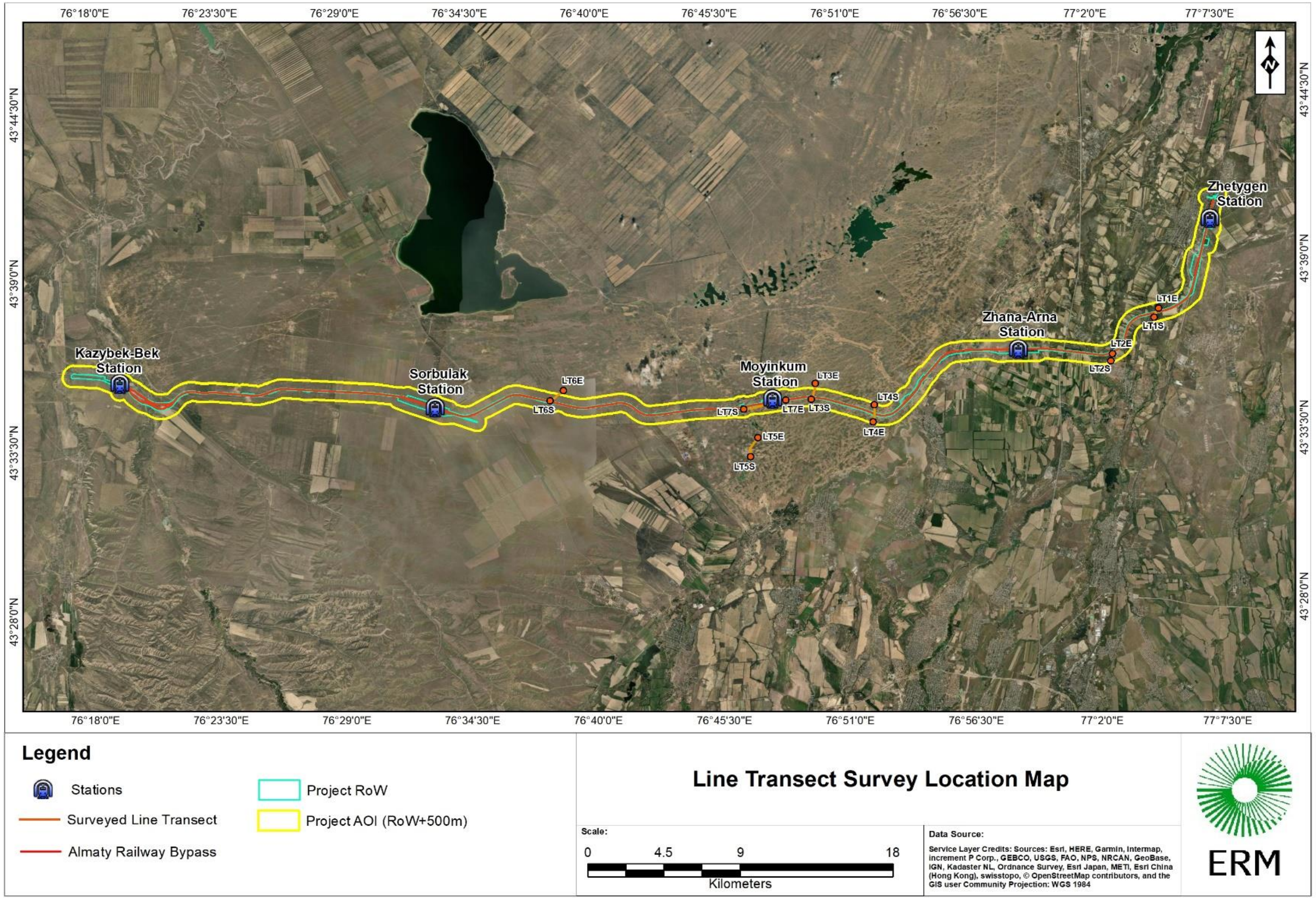


TABLE 6-85: DETAILS OF LINE TRANSECTS/SURVEY ROUTES

Transect #	Date of survey	Start Point		End Point		Habitat Type
		Latitude	Longitude	Latitude	Longitude	
LT1	27 November 2024	43°37'11.52"N	77° 4'42.94"E	43°37'29.15"N	77° 4'55.62"E	Riverine habitat with reed beds
LT2	27 November 2024	43°35'48.30"N	77° 2'46.26"E	43°36'2.09"N	77° 2'50.84"E	Agriculture land and scrub
LT3	27 November 2024	43°34'46.93"N	76°49'35.48"E	43°35'17.63"N	76°49'47.16"E	Semi-desert habitat
LT4	28 November 2024	43°34'33.03"N	76°52'20.91"E	43°33'59.88"N	76°52'17.20"E	Semi-desert habitat
LT5	28 November 2024	43°32'57.12"N	76°46'52.48"E	43°33'33.60"N	76°47'12.91"E	Mosaic of semi-desert and steppe/pastureland habitat
LT 6	28 November 2024	43°34'53.96"N	76°38'9.23"E	43°35'13.52"N	76°38'44.55"E	Steppe/pastureland habitat
LT 7	28 November 2024	43°34'29.88"N	76°46'37.65"E	43°34'46.36"N	76°48'28.43"E	Degraded steppe / pastureland habitat

Stakeholder Consultations

Consultations were conducted with the officials of the Regional Committee of Wildlife and Forestry, as well as with subject matter experts (SMEs) from the Association for the Conservation of Biodiversity in Kazakhstan (ACBK)[139] and BirdLife International. The ACBK focus on conserving Kazakhstan's biodiversity, promoting its sustainable use, and engaging the public on its importance. Key activities include implementing wildlife conservation projects, improving research, advocating for policy improvements, and expanding conservation networks nationwide. Details of the stakeholders consulted is summarised in **Table 6-86**.

TABLE 6-86: DETAILS OF STAKEHOLDERS CONSULTED

No.	Organisation	Designation/Specialisation
1.	Association for the Conservation of Biodiversity of Kazakhstan	Head of the Centre for Conservation Biology of ACBK, Science Director of ACBK
2.	Regional Committee of Wildlife and Forestry	Head of Forestry Department
		Official Forestry Department
		EIA Consultant (Integra) of the Project

6.6.3 SURVEY RESULTS

6.6.3.1 HABITAT MAPPING AND FLORAL COMPOSITION

The AoI consists of natural habitats (semi-desert habitat and riverine habitat), and modified habitats (pastureland and agriculture land). Agriculture accounts for 36.81% (35.27 km^2) of the AoI, while steppe/pastureland constitutes 31.22% (29.92 km^2), significant grazing activity was observed. Semi-desert habitats cover 21.39% (20.5 km^2), with certain portions retaining natural characteristics despite grazing pressures. Waterbody habitats, including floodplains and reedbeds, occupy 2.61 and 0.22% respectively (2.61 km^2 and 0.22 km^2 respectively). Open scrub vegetation and built-up areas form smaller fractions, at 1.80% (1.72 km^2) and 5.82% (5.58 km^2), respectively.

Tree lines, intentionally planted to act as natural barriers against drifting snow were observed along the railway alignment. These, along with access tracks and field boundaries, are inherently linked to agricultural and grazing practices and emphasize the anthropogenic influence on the landscape.

Within the RoW, a total of 0.1349 km^2 of riverine habitat and 0.518 km^2 of semi-desert habitat will be lost due to project activities, resulting in partial habitat reduction and potential ecological impacts.

All habitat types or land use/land cover types were assessed as per IFC PS6 11-15 and IFC PS6 GN38-4.

[139] Kazakhstan - Association for the Conservation of Biodiversity of Kazakhstan (ACBK) - BirdLife International

TABLE 6-87: SCREENING OF NATURAL AND MODIFIED HABITAT

IFC Habitat Classification	Habitat Type based on Land Use/ Land Cover	Rationale for Habitat Classification	Interaction with Project
Modified Habitat	Agriculture	Agricultural habitats are highly modified as humans constantly use and change this type of habitat/ land use to increase the productivity of their fields. Agricultural habitats are thereby classified as modified habitat.	The Project AoI consists of 36.81 % of agriculture land and 31.22% of pastureland.
	Steppe/Pastureland	Pastureland habitats within the study area are overgrazed and support livestock from local villages. Moreover, low rainfall results in poor regeneration or germination. Considering constant grazing pressure and spread of invasive alien species (IAS), it is anticipated that these habitat type have been modified through generations of grazing activity. Thus, they are considered as modified habitat.	
	Built-up	Approximately 5.82% of the study area is designated as built-up area, consisting of residential structures and livestock sheds. This indicates substantial human modification and habitat alteration, aligning with the classification of modified habitat.	
Natural Habitat	Semi-desert	Semi-desert habitat comprises 21.39% of the AoI, with approximately 2.52% (0.518 km² out of 20.50 km²) retaining its natural characteristics. Of this identified natural habitat segment, 0.195 km² will be lost within the RoW. Despite grazing pressure, this portion supports native vegetation adapted to arid and semi-arid conditions and is predominantly of native origin. Anthropogenic activities have not significantly modified its primary ecological functions or native species composition. Supporting its classification as natural habitat.	Out of 20.50 km² (2,050 hectares) of semi-desert habitat within the AoI, 0.518 km² (51.80 hectares) retains its natural characteristics. Within this, 0.195 km² (19.5 hectares) will be lost within the RoW, leading to a partial reduction of natural habitat.

IFC Habitat Classification	Habitat Type based on Land Use/ Land Cover	Rationale for Habitat Classification	Interaction with Project
	Waterbody habitat including riverine habitat	Waterbody habitats, including floodplains and reedbeds, occupy 32.61 and 0.2237% respectively (2.61 km^2 and 0.22 km^2 respectively). These habitats provide suitable breeding and roosting conditions for species associated with riparian habitat. While localised anthropogenic pressures may exist, the primary ecological functions and species composition remain intact. Thus, this habitat has been considered as natural habitat.	0.22 km^2 of the riverine habitat within the AoI retains its natural characteristics and will be impacted. Of this, 0.1349 km^2 of natural riverine habitat within the RoW will be lost and result in partial habitat reduction.

Steppe/Pastureland habitat

A significant portion of the alignment traverses a mosaic of highly degraded and overgrazed areas, interspersed with some patches of relatively better condition steppe grasslands. These lands are extensively utilised as pasture for local livestock, including sheep, goats, and horses. The area is subject to considerable pressure from grazing, increasing the presence and spread of various invasive alien species (IAS). The dominant grass species observed within the AoI belong to the genera *Stipa* and *Festuca.*

Semidesert habitat

The semi-desert habitat along the railway alignment features a characteristic arid environment with sparse vegetation adapted to the region’s dry conditions. This landscape supports a variety of flora, including drought-resistant grasses like *Stipa* and *Festuca*, along with xerophytic shrubs such as *Salsola arbuscula*, *Artemisia* spp., and *Calligonum* spp. Species that may potentially use this habitat and be present at the project site include Red fox (*Vulpes vulpes*) [LC (IUCN v2024-1)], Corsac fox (*Vulpes corsac*) [LC (IUCN v2024-1)], Yellow ground squirrel (*Spermophilus fulvus*) [LC (IUCN v2024-1)], Red-cheeked ground squirrel (*Spermophilus erythrogenys*) [LC (IUCN v2024-1)], and various rodents such as the Great gerbil (*Rhombomys opimus*) [LC (IUCN v2024-1)]. These species are categorised as Least Concern and have wide-ranging distributions.

Waterbody habitat

The alignment intersects multiple rivers across various locations, with one section crossing a riverine habitat characterised by extensive reed beds (43°37'20.50"N, 77° 4'47.64"E). This habitat provides suitable breeding and roosting conditions for several passerine species, including Common chiffchaff (*Phylloscopus collybita*) [LC (IUCN v2024-1)], Coal Tit (*Periparus ater*) [LC (IUCN v2024-1)], Great Tit (*Parus major*) [LC (IUCN v2024-1)] as well as for wetland-associated species such as Common Coot (*Fulica atra*) [LC (IUCN v2024-1)], Common Moorhen (*Gallinula chloropus*) [LC (IUCN v2024-1)], Eurasian Bittern (*Botaurus stellaris*) [LC (IUCN v2024-1)], Little Grebe (*Tachybaptus ruficollis*) [LC (IUCN v2024-1)], Black-necked Grebe (*Podiceps nigricollis*) [LC (IUCN v2024-1)] etc. The surrounding vegetation primarily consists of Russian Olive (*Elaeagnus angustifolia*).

Agriculture habitat

The project alignment passes through agriculture lands in various sections. The agriculture lands are not irrigated and commonly grow crops in the region include Wheat, Barley, Maize and Hay.

The habitat types that are present in the AoI are depicted in **Figure 6-31**. The Habitat characterisation of Project AoI is shown in **Figure 6-32** and areas of natural habitat loss within the project RoW is indicated in **Figure 6-33**. **Table 6-88** summarises the habitat classification of the Project AOI.

FIGURE 6-31: HABITAT TYPES PRESENT IN THE AOI

Agriculture land

Riparian habitat

Steppe/Pastureland

Semi-desert

FIGURE 6-32: HABITAT CHARACTERISATION OF PROJECT AOI

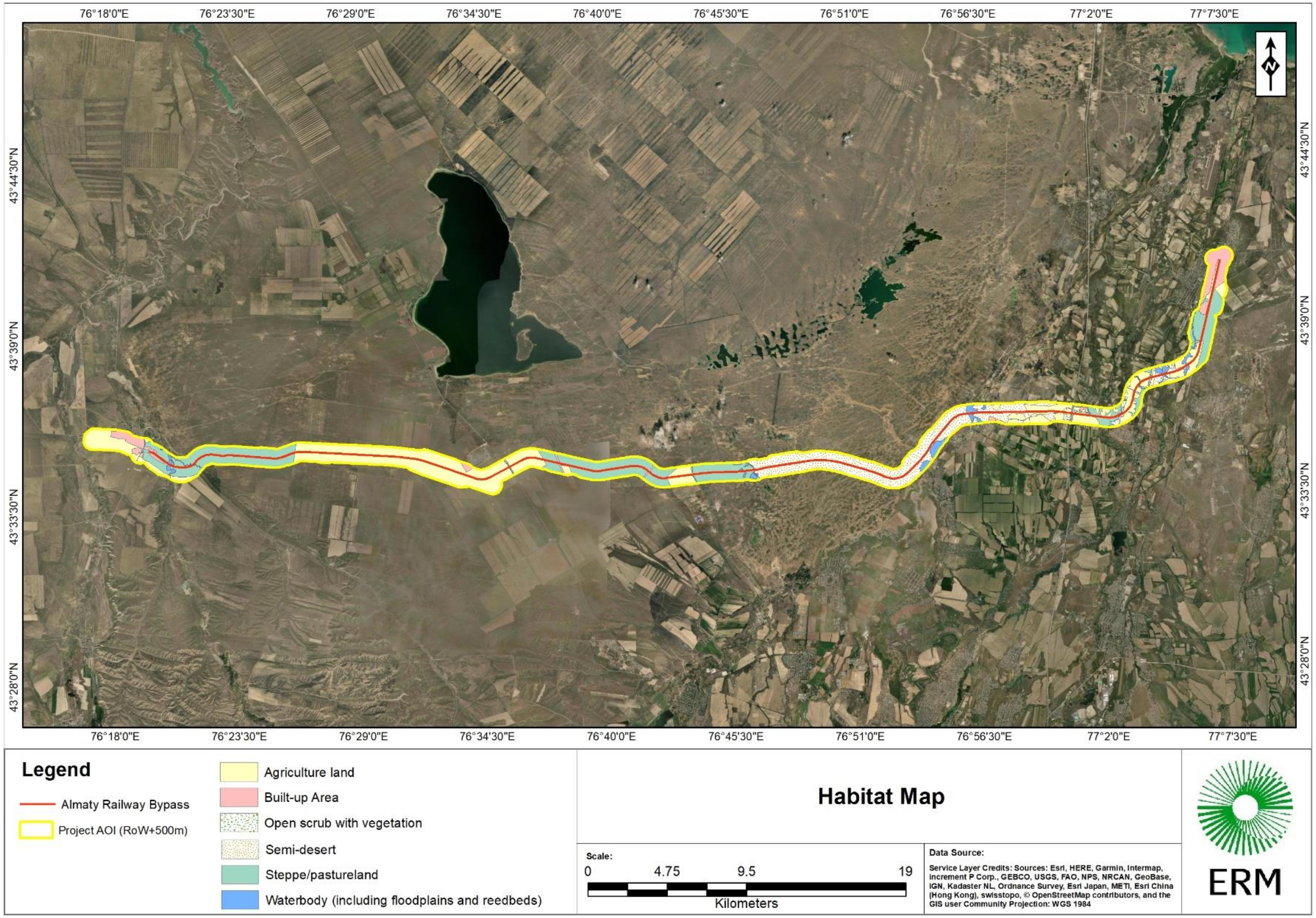


FIGURE 6-33: AREAS OF NATURAL HABITAT LOSS WITHIN THE PROJECT ROW

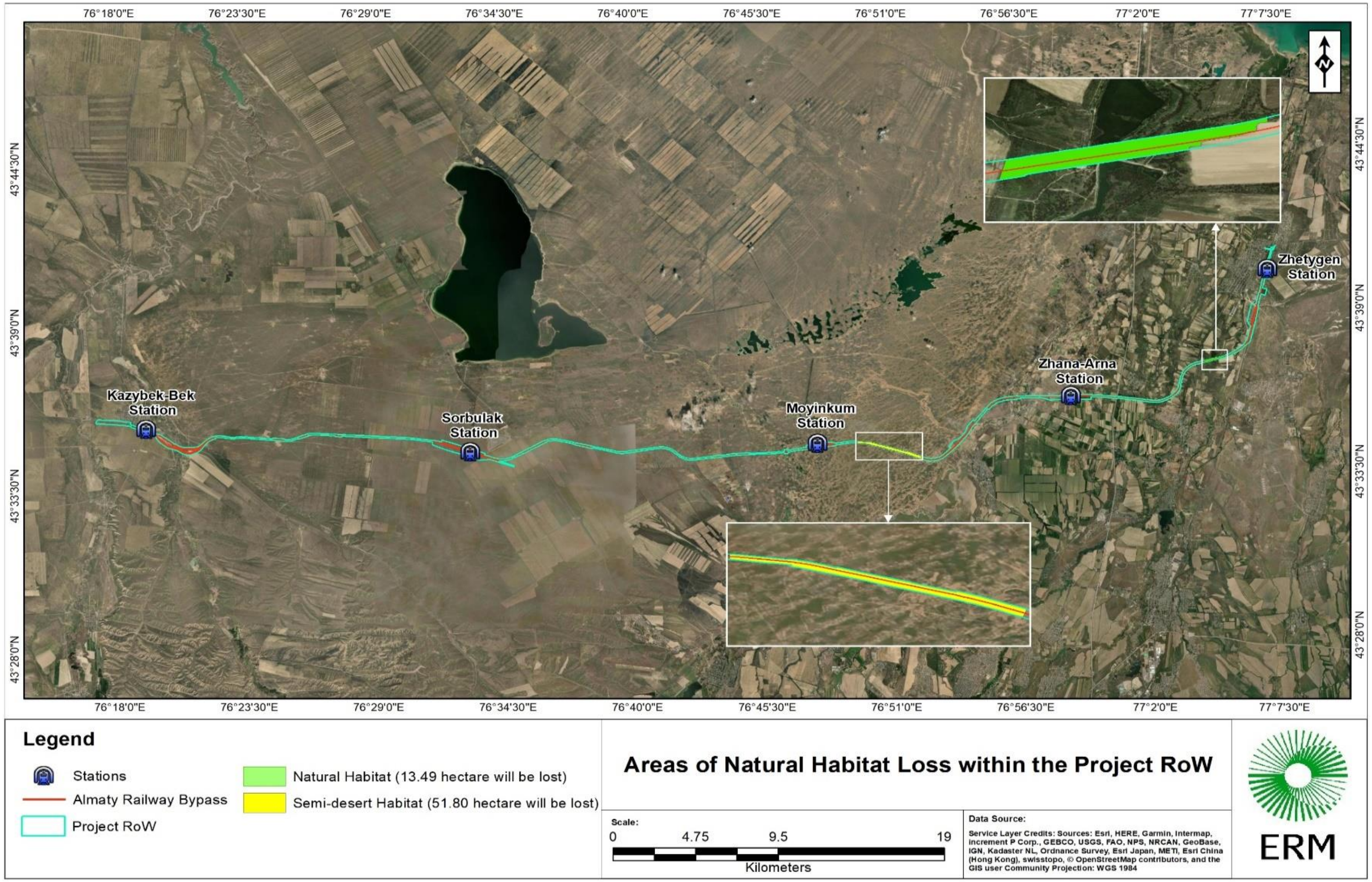


TABLE 6-88: HABITAT CLASSIFICATION OF THE PROJECT AOI

Category	Area (km^2)	Percentage (%)
Agriculture	35.27	36.81
Built-up Area	5.58	5.82
Open scrub with vegetation	1.72	1.80
Semi Desert	20.50	21.39
Steppe/pastureland	29.91	31.22
Waterbody (including floodplains)	2.61	2.72
Riverine (reedbeds)	0.22	0.23
Total	95.80	100.00

6.6.3.2 LEGALLY PROTECTED AND INTERNATIONALLY RECOGNISED AREAS

One site of higher biodiversity conservation significance was identified to be located within the AoI of the project, namely, the Sorbulak Lake System (the project passes through the IBA). The lake system is a designated Important Bird Area (IBA).

Sorbulak Lake System

IBA Criteria: **A1** (Globally threatened species), **A4i** (holds, on a regular basis, 1% or more of a biogeographic population of a congregatory waterbird species) and **A4iii** (holds, on a regular basis, at least 20,000 waterbirds, or at least 10,000 pairs of seabird, of one or more species).

Distance from the Project: The project passes through the IBA in the southern part. The larger lake together with a cluster of smaller lakes lie approximately 5km north of the alignment.

Important Biodiversity Values: Approximately 300 species across 18 orders have been documented at the site. Among the most prevalent are Anseriformes, with 28 species, and Charadriiformes, with over 50 species. The site has supported some of the largest breeding colonies in southeastern Kazakhstan for species including the Black-headed Gull (*Chroicocephalus ridibundus*, LC) with 8,000 pairs, Gull-billed Tern (*Gelochelidon nilotica*, LC) with 2,500 pairs, Great Cormorant (*Phalacrocorax carbo*, LC) with 5,000 pairs, Collared Pratincole (*Glareola pratincola*, LC) with 140 pairs, and Black-winged Stilt (*Himantopus himantopus*, LC) with 70 pairs. The Common Shelduck (*Tadorna tadorna*, LC) and Ruddy Shelduck (*Tadorna ferruginea*, LC) breed along the coast, with up to 100 pairs or more, and post-breeding moult gatherings of T. ferruginea reaching up to 20,000 individuals. Large numbers of migrating wildfowl have been observed, including up to 50,000 Mallards (*Anas platyrhynchos*, LC), 35,000 Northern Pintails (*Anas acuta*, LC), 15,000 Red-crested Pochards (*Netta rufina*, LC), and 40,000 Eurasian Coots (*Fulica atra*, LC). During winter, Smew (*Mergellus albellus*, LC) populations can reach 12,000, and Mallards populations can reach 20,000. Migrating passerines, including the Common Starling (*Sturnus vulgaris*, LC), Rosy Starling (*Pastor roseus*, LC), Barn Swallow (*Hirundo rustica*, LC), Eurasian Crag Martin

(*Ptyonoprogne rupestris*, LC), and various Motacilla (Wagtail) species, concentrate in the shoreline vegetation, with numbers exceeding 50,000.

Based on the findings of primary surveys and site visit observations, no direct interactions between the project and the Sorbulak Lake System are anticipated. The Sorbulak Lake waterbody is located approximately 5km north of the railway alignment. Although the alignment overlaps with the designated KBA boundary for a ~4km stretch, this section consists of overgrazed steppe grassland habitat and does not intersect with the lake itself. Observed avian congregations were exclusively associated with the waterbody, which lies beyond the project AoI.

The portion of the IBA extending south of the project footprint is characterised by steppe and grassland habitats with small natural depressions containing water. The small water bodies south of the alignment were found to be dry and lacked the necessary habitat to support large numbers of migratory or congregatory species that may potentially move from the lake system. Consequently, construction and operational activities are not expected to impact the habitats or biodiversity values of the Sorbulak Lake System. Potential impacts are anticipated to be consistent with those outlined in **Section 6.6.7** pertaining to construction and operational activities in the broader project context. The Sorbulak Lake System IBA in relation to the project alignment is depicted in **Figure 6-34**, while **Figure 6-35** presents photos of the avifauna observed along the Sorbulak IBA.

FIGURE 6-34: SORBULAK LAKE SYSTEM IBA WITH RESPECT TO THE PROJECT ALIGNMENT

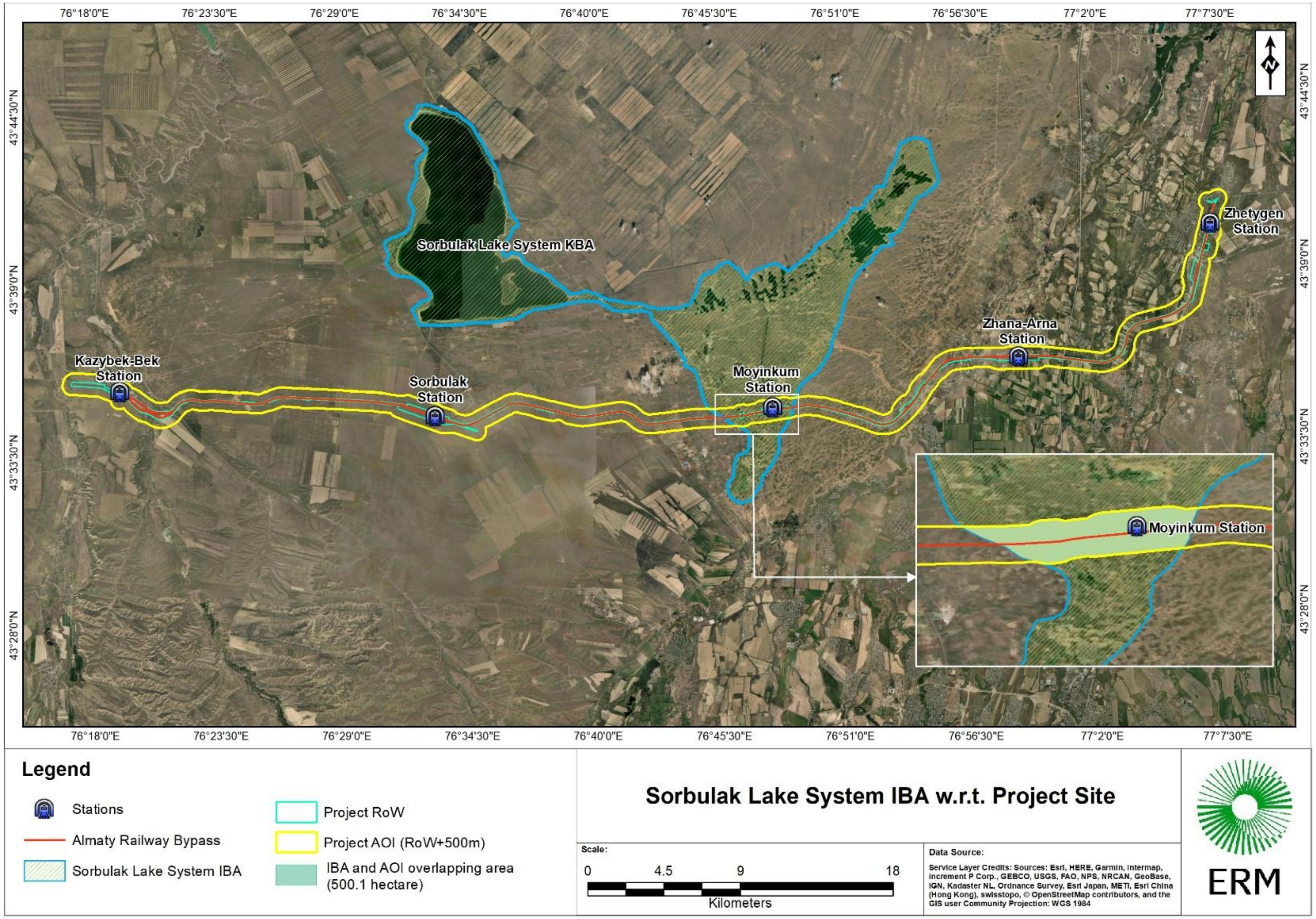


FIGURE 6-35: PHOTOGRAPHIC DOCUMENTATION OF AVIFAUNA OBSERVED ALONG THE SORBULAK IBA


Congregation of Ruddy Shelduck at Sorbulak Lake


Congregation of Mallards and Common Coot


Congregation of Common Coot and Common Shelduck


Congregation of Black-headed Gull


Congreation of Tufted Duck


Sorbulak Lake

6.6.3.3 FAUNAL ANALYSIS

The search techniques described in **Section 6.6.6** were used to identify the target fauna – herpetofauna (amphibians and reptiles), avifauna and mammal species. The subsequent sections provide the list of observed and recorded fauna.

Avifauna

Species identified in the iBAT report were screened through secondary databases, including eBird[140] and iNaturalist, as well as relevant literature sources. Based on habitat suitability within the site, primary field observations, and stakeholder consultations, species with a potential presence in the AoI[141] were assessed and cataloged. A total of 181 species of avifauna have been observed and reported from the area of influence. Of the 175 species, 69 species were observed during the Supplementary ESIA primary survey. At least five (5) individuals of the IUCN endangered Steppe Eagle (*Aquila nipalensis*) were observed each day during the primary survey from the AoI. Additionally, two (2) vulnerable species namely, Common Pochard (*Aythya ferina*) and European Turtle-dove (*Streptopelia turtur*) were observed during the primary surveys. Further, eight near- threatened species namely, Black-tailed Godwit (*Limosa limosa*), Cinereous Vulture (*Aegypius monachus*), Ferruginous Duck (*Aythya nyroca*), Great Snipe (*Gallinago media*), Little Bustard (*Tetrax tetrax*), Marbled Teal (*Marmaronetta angustirostris*), Northern Lapwing (*Vanellus vanellus*), Pallid Harrier (*Circus macrourus*) were observed during the primary survey.

As for the reported species, four IUCN endangered species namely, Egyptian Vulture (*Neophron percnopterus*), Pallas's Fish-eagle (*Haliaeetus leucoryphus*), Saker Falcon (*Falco cherrug*), White-headed Duck (*Oxyura leucocephala*). Additionally, four IUCN vulnerable (VU) species: Asian Houbara (*Chlamydotis macqueenii*), Eastern Imperial Eagle (*Aquila heliacal*), Greater Spotted Eagle (*Clanga clanga*) and Horned Grebe (Podiceps auratus) and three near-threatened species Eurasian Curlew (*Numenius arquata*), Eurasian Oystercatcher (*Haematopus ostralegus*), Himalayan Griffon (*Gyps himalayensis*) have been reported. All the other reported species have been classified as least concern as per the latest IUCN Red List (Online Version 2024-1).

20 of the 181 species are listed in the Red Data Book of the Republic of Kazakhstan. Eight of the twenty were observed during the primary survey namely, Booted Eagle (*Hieraaetus pennatus*) [LC (IUCN v2024-1)], Dalmatian Pelican (*Pelecanus crispus*) [NT (IUCN v2024-1)], Ferruginous Duck (*Aythya nyroca*) [NT (IUCN v2024-1)], Great White Pelican (*Pelecanus onocrotalus*) [LC (IUCN v2024-1)], Little Bustard (*Tetrax tetrax*) [NT (IUCN v2024-1)], Short-toed Snake-eagle (*Circaetus gallicus*) [LC (IUCN v2024-1)], Steppe Eagle (*Aquila nipalensis*) [EN (IUCN v2024-1)], White-tailed Sea-eagle (*Haliaeetus albicilla*) [LC (IUCN v2024-1)].

Raptors

27 species of raptors are reported and observed from the AoI, of these 12 species were observed during the primary survey of the Supplementary ESIA study namely, Black Kite (*Milvus migrans*) [LC (IUCN v2024-1)], Booted Eagle (*Hieraaetus pennatus*) [LC (IUCN v2024-1)], Cinereous Vulture (*Aegypius monachus*) [NT (IUCN v2024-1)], Common Kestrel

[140] Bird List - Lake Sorbulak--General Area; (IBA KZ097), Almaty oblysy, Kazakhstan - eBird Hotspot
[141] Almaty, KZ · iNaturalist

(*Falco tinnunculus*) [LC (IUCN v2024-1)], Eurasian Hobby (*Falco Subbuteo*) [LC (IUCN v2024-1)], Long-legged Buzzard (*Buteo rufinus*) [LC (IUCN v2024-1)], Montagu's Harrier (*Circus pygargus*) [LC (IUCN v2024-1)], Pallid Harrier (*Circus macrourus*) [NT (IUCN v2024-1)], Short-toed Snake-eagle (*Circaetus gallicus*) [LC (IUCN v2024-1)], Steppe Eagle (*Aquila nipalensis*) [EN (IUCN v2024-1)], Western Marsh-harrier (*Circus aeruginosus*) [LC (IUCN v2024-1)], White-tailed Sea-eagle (*Haliaeetus albicilla*) [LC (IUCN v2024-1)].

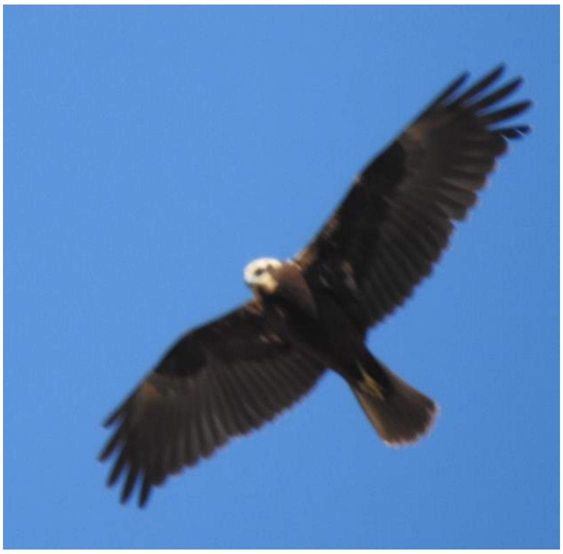
Of the reported raptors, three EN species namely, Egyptian Vulture (*Neophron percnopterus*), Pallas's Fish-eagle (*Haliaeetus leucoryphus*), Saker Falcon (*Falco cherrug*) and two (2) VU species are reported namely, Eastern Imperial Eagle (*Aquila heliaca*), Greater Spotted Eagle (*Clanga clanga*). 12 of the 27 species are listed in the Red Data Book of the Republic of Kazakhstan. The complete list is provided in **Table 6-89**. **Figure 6-36** presents photos of the Raptors observed in the AoI.

TABLE 6-89: SUMMARY OF THE RAPTORS REPORTED FROM THE PROJECT SITE AND AOI

No.	Common Name	Species Name	IUCN v. 2024-1	Red Data Book of Kazakhstan Category	Migratory Status	Observed/Reported
1	Black Kite	*Milvus migrans*	LC	-	M	O
2	Booted Eagle	*Hieraaetus pennatus*	LC	Category III	M	O
3	Cinereous Vulture	*Aegypius monachus*	NT	-	M	O
4	Common Kestrel	*Falco tinnunculus*	LC	-	M	O
5	Eastern Imperial Eagle	*Aquila heliaca*	VU	Category III	M	R
6	Egyptian Vulture	*Neophron percnopterus*	EN	Category III	M	R
7	Eurasian Buzzard	*Buteo buteo*	LC	-	M	R
8	Eurasian Hobby	*Falco subbuteo*	LC	-	M	O
9	Golden Eagle	*Aquila chrysaetos*	LC	Category III	M	R
10	Greater Spotted Eagle	*Clanga clanga*	VU	-	M	R
11	Hen Harrier	*Circus cyaneus*	LC	-	M	R
12	Himalayan Griffon	*Gyps himalayensis*	NT	Category IV	M	R
13	Lesser Kestrel	*Falco naumanni*	LC	-	M	R
14	Long-legged Buzzard	*Buteo rufinus*	LC	-	M	O
15	Montagu's Harrier	*Circus pygargus*	LC	-	M	O
16	Osprey	*Pandion haliaetus*	LC	Category I	M	R
17	Pallas's Fish-eagle	*Haliaeetus leucoryphus*	EN	Category I	M	R
18	Pallid Harrier	*Circus macrourus*	NT	-	M	O

No.	Common Name	Species Name	IUCN v. 2024-1	Red Data Book of Kazakhstan Category	Migratory Status	Observed/Reported
19	Peregrine Falcon	*Falco peregrinus*	LC	Category II	M	R
20	Rough-legged Buzzard	*Buteo lagopus*	LC	-	M	R
21	Saker Falcon	*Falco cherrug*	EN	Category I	M	R
22	Shikra	*Accipiter badius*	LC	-	M	R
23	Short-toed Snake-eagle	*Circaetus gallicus*	LC	Category II	M	O
24	Steppe Eagle	*Aquila nipalensis*	EN	Category V	M	O
25	Upland Buzzard	*Buteo hemilasius*	LC	-	M	R
26	Western Marsh-harrier	*Circus aeruginosus*	LC	-	M	O
27	White-tailed Sea-eagle	*Haliaeetus albicilla*	LC	Category II	M	O

FIGURE 6-36: RAPTORS OBSERVED IN THE PROJECT AOI



Western-marsh Harrier

Eurasian Hobby

Long-legged Buzzard

Steppe Eagle

Wetland associated migratory and congregatory species

Wetland-associated migratory and congregatory species were recorded during the primary surveys. A total of 38 species are reported and observed within the AoI, of which 24 species were observed during the primary surveys. One of the observed species was IUCN vulnerable (VU) Common Pochard (*Aythya ferina*) and four were IUCN near-threatened (NT) namely, Black-tailed Godwit (*Limosa limosa*), Ferruginous Duck (*Aythya nyroca*), Great Snipe (*Gallinago media*) and Marbled Teal (*Marmaronetta angustirostris*). Six (6) of the 38 species are listed in the Red Data Book of the Republic of Kazakhstan. A complete list of these species is provided in **Table 6-90.**

TABLE 6-90: WETLAND ASSOCIATED RESIDENT SPECIES REPORTED FROM THE PROJECT SITE AND AOI

No.	Common Name	Species Name	IUCN v. 2024-1	Red Book of Kazakhstan Category	Observed / Reported
1	Bar-headed Goose	*Anser indicus*	LC	-	R
2	Black-crowned Night-heron	*Nycticorax nycticorax*	LC	-	R
3	Black-necked Grebe	*Podiceps nigricollis*	LC	-	O
4	Black-tailed Godwit	*Limosa limosa*	NT	-	O
5	Common Coot	*Fulica atra*	LC	-	O
6	Common Kingfisher	*Alcedo atthis*	LC	-	O
7	Common Moorhen	*Gallinula chloropus*	LC	-	O
8	Common Pochard	*Aythya ferina*	VU	-	O
9	Common Redshank	*Tringa totanus*	LC	-	O
10	Common Sandpiper	*Actitis hypoleucos*	LC	-	O
11	Common Shelduck	*Tadorna tadorna*	LC	-	O
12	Dalmatian Pelican	*Pelecanus crispus*	NT	Category II	R
13	Eurasian Bittern	*Botaurus stellaris*	LC	-	R
14	Eurasian Spoonbill	*Platalea leucorodia*	LC	Category II	R
15	Ferruginous Duck	*Aythya nyroca*	NT	Category II	O
16	Gadwall	*Mareca strepera*	LC	-	R
17	Garganey	*Spatula querquedula*	LC	-	R
18	Goosander	*Mergus merganser*	LC	-	R
19	Great Cormorant	*Phalacrocorax carbo*	LC	-	O
20	Great Crested Grebe	*Podiceps cristatus*	LC	-	O
21	Great Snipe	*Gallinago media*	NT	-	O

No.	Common Name	Species Name	IUCN v. 2024-1	Red Book of Kazakhstan Category	Observed / Reported
22	Great White Egret	*Ardea alba*	LC	-	O
23	Great White Pelican	*Pelecanus onocrotalus*	LC	Category I	O
24	Green Sandpiper	*Tringa ochropus*	LC	-	O
25	Grey Heron	*Ardea cinerea*	LC	-	O
26	Greylag Goose	*Anser anser*	LC	-	R
27	Horned Grebe	*Podiceps auritus*	VU	-	R
28	Little Grebe	*Tachybaptus ruficollis*	LC	-	O
29	Mallard	*Anas platyrhynchos*	LC	-	O
30	Marbled Teal	*Marmaronetta angustirostris*	NT	-	O
31	Northern Pintail	*Anas acuta*	LC	-	O
32	Northern Shoveler	*Spatula clypeata*	LC	-	O
33	Red-crested Pochard	*Netta rufina*	LC	-	O
34	Red-necked Grebe	*Podiceps grisegena*	LC	-	R
35	Ruddy Shelduck	*Tadorna ferruginea*	LC	-	O
36	Smew	*Mergellus albellus*	LC	-	R
37	White-headed Duck	*Oxyura leucocephala*	EN	Category I	R
38	Whooper Swan	*Cygnus cygnus*	LC	Category II	R

Herpetofauna

The herpetofaunal diversity observed during the primary survey and reported in secondary literature[142][143] from the Project AoI includes 30 species, comprising lizards, snakes, amphibians, and a tortoise, distributed across 11 families. Lizards dominate the assemblage, with species belonging to the families such as Lacertidae, Agamidae, Gekkonidae, Scincidae, and Psammophiidae, including species like the Central Asian Racerunner (*Eremias velox* [LC]) and the Spotted Toadhead Agama (*Phrynocephalus guttatus* [LC]). Snakes, represented by

[142] Almaty, KZ · iNaturalist
[143] Lambert, M. R. K. (1998). Preliminary observations on herpetofaunal diversity in the Almaty region, southern Kazakhstan. Environmental Sciences Department, Natural Resources Institute, University of Greenwich, Central Avenue, Chatham Maritime, Kent ME4 4TB, U.K.

Colubridae, Viperidae, Psammophiidae, and Boidae, include species such as the Dice Snake (*Natrix tessellata* [LC]) and the Eastern Steppe Viper (*Vipera renardi* [NT]). Amphibians are documented under Ranidae and Bufonidae, with species like *Rana asiatica* [VU] and the European Green Toad (*Bufotes viridis* [LC]). Additionally, the Central Asian Tortoise (*Agrionemys horsfieldii* [VU]) has been reported and observed accidently during the current excavation due to their tendency to burrow in sandy or loamy soils for hibernation or shelter. Two species are listed as Vulnerable (*Rana asiatica* and *Agrionemys horsfieldii*), while the rest are categorised as Least Concern. None of species are listed in the Red Data Book of the Republic of Kazakhstan. A complete list of these species is provided in **Table 6-91**.

Table 6-91: Herpetofauna reported from the from the Project Site and AoI

No.	Common Name	Scientific Name	Family	IUCN Category v2024-2	Observed / Reported
1	Aralo-Caspian Racerunner	Eremias intermedia	Lacertidae	LC	R
2	Central Asian Racerunner	Eremias velox	Lacertidae	LC	R
3	Desert Lidless Skink	Ablepharus deserti	Scincidae	LC	R
4	Dice Snake	Natrix tessellata	Colubridae	LC	R
6	Eastern Steppe Viper	Vipera renardi	Viperidae	NT	R
7	Even-fingered Gecko	Alsophylax pipiens	Gekkonidae	LC	R
8	Grass Snake	Natrix natrix	Colubridae	LC	R
9	Reticulate Racerunner	Eremias grammica	Lacertidae	LC	R
10	Sand Racerunner	Eremias scripta	Lacertidae	LC	O
11	Spotted Toadhead Agama	Phrynocephalus guttatus	Agamidae	LC	R
12	Steppe Agama	Trapelus sanguinolentus	Agamidae	LC	R
13	Steppe Ribbon Racer	Psammophis lineolatus	Psammophiidae	LC	R
14	Steppe-runner	Eremias arguta	Lacertidae	LC	R
15	Steppes Ratsnake	Elaphe dione	Colubridae	LC	R
16	Striped Racerunner	Eremias lineolata	Lacertidae	LC	R
17	Sunwatcher	Phrynocephalus helioscopus	Agamidae	LC	R

No.	Common Name	Scientific Name	Family	IUCN Category v2024-2	Observed / Reported
18	Tartar Sand Boa	Eryx tataricus	Boidae	LC	R
19	Toad-headed Agama	Phrynocephalus mystaceus	Agamidae	LC	R
20	Transcaspian Bent-toed Gecko	Mediodactylus russowii	Gekkonidae	LC	R
21	-	Rana asiatica	Ranidae	VU	R
22	-	Phrynocephalus incertus	Agamidae	LC	R
23	European green toad	Bufotes viridis	Bufotes	LC	R
24	Xinjiang Toad	Bufotes pewzowi	Bufonidae	LC	R
25	Marsh frog	Pelophylax ridibundus	Ranidae	LC	O
26	Central Asian Tortoise	Testudo horsfieldii	Testudinidae	VU	R

Source: IBAT, iNaturalist, primary observations and consultation and secondary literature

Mammals

Species identified in the iBAT report for the Project AoI were assessed using a combination of secondary data sources, including iNaturalist, supplemented by habitat suitability analyses, primary field observations, and stakeholder consultations. A total of 22 species have been reported from the AoI and larger landscape. Among these, the Goitered Gazelle (*Gazella subgutturosa*) is classified as Vulnerable under the IUCN Red List v2024-2 and is listed under Category III in the Red Data Book of Kazakhstan. The remaining species, are categorised as Least Concern under the IUCN and are not listed in the Red Data Book of Kazakhstan. A complete list of these species is provided in **Table 6-92**.

TABLE 6-92: MAMMALS REPORTED FROM THE PROJECT SITE AND AOI

No.	Common Name	Scientific Name	IUCN Category v2024-2	Red Book of Kazakhstan Category	Observed/ Reported
1	Corsac Fox	*Vulpes corsac*	LC	-	R
2	Dwarf Fat-tailed Jerboa	*Pygeretmus pumilio*	LC	-	R
3	Goitered Gazelle	*Gazella subgutturosa*	VU	Category III	R
4	Great Gerbil	*Rhombomys opimus*	LC	-	R
5	Great Jerboa	*Allactaga major*	LC	-	R

No.	Common Name	Scientific Name	IUCN Category v2024-2	Red Book of Kazakhstan Category	Observed/ Reported
6	Greater Fat-tailed Jerboa	*Pygeretmus zhitkovi*	LC	-	R
7	House Mouse	*Mus musculus*	LC	-	R
8	Libyan Jird	*Meriones libycus*	LC	-	R
9	Long-clawed Ground Squirrel	*Spermophilopsis leptodactylus*	LC	-	R
10	Long-eared Hedgehog	*Hemiechinus auritus*	LC	-	R
11	Mid-day Gerbil	*Meriones meridianus*	LC	-	R
12	Noctule	*Nyctalus noctula*	LC	-	R
13	Particoloured Bat	*Vespertilio murinus*	LC	-	R
14	Red Fox	*Vulpes vulpes*	LC	-	R
15	Red-cheeked Ground Squirrel	*Spermophilus erythrogenys*	LC	-	R
16	Small Five-toed Jerboa	*Scarturus elater*	LC	-	R
17	Steppe Polecat	*Mustela eversmanii*	LC	-	R
18	Tamarisk Gerbil	*Meriones tamariscinus*	LC	-	R
19	Tolai Hare	*Lepus tolai*	LC	-	R
20	Yellow Ground Squirrel	*Spermophilus fulvus*	LC	-	R
21	Zaisan Mole Vole	*Ellobius tancrei*	LC	-	R
22		*Crocidura gmelini*	LC	-	R

Ichthyofauna

Discussions with subject matter experts studying aquatic species in Kazakhstan indicated that the small river stretches interacting with the project area serve as habitat for some fish species. The iBAT report identified five threatened species within the Project AoI, which were evaluated using secondary data sources[144][145][146][147][148], including iNaturalist records, habitat suitability analyses, primary field observations, and stakeholder consultations. The Critical Habitat Assessment determined that none of these species qualify as critical habitat candidates due to factors such as local extirpation from adjacent rivers, regional population declines, and the presence of strongholds in the Lake Balkhash and Lake Alakol basins north of the project. Given these considerations, the potential loss of any population within the AoI is unlikely to impact the species' IUCN Red List status. Although records indicate occasional presence, the species are rare in these rivers, exhibit declining trends, and have limited availability of preferred habitat within the AoI.

Including both native and alien species, a total of 25 fish species have been reported from the AoI and the larger landscape. Among these, five species—Seven River's Minnow (*Phoxinus brachyurus*), Balkhash Marinka (*Schizothorax argentatus*), Ili Marinka (*Schizothorax pseudaksaiensis*), Severtsov's Loach (*Nemacheilus sewerzowi*), and Plain Thicklip Loach (*Triplophysa labiata*)—are classified as Vulnerable under the IUCN Red List v2024-2. One species, the Rosy Bitterling (*Rhodeus ocellatus*), is categorised as Data Deficient. The remaining species are classified as Least Concern under the IUCN Red List. A complete list of these species is provided in **Table 6-93**.

TABLE 6-93: ICTHYOFAUNA REPORTED FROM THE PROJECT SITE AND AOI

S.No.	Common Name	Scientific Name	Family	IUCN Category v2024-2
Native Species				
1	Seven River's Minnow	*Phoxinus brachyurus* Berg, 1912	Cyprinidae	VU
2	Balkhash Minnow	*Lagowskiella poljakowi* (Kessler, 1879)	Cyprinidae	LC
3	Balkhash Marinka	*Schizothorax argentatus* Kessler, 1874	Cyprinidae	VU
4	Ili Marinka	*Schizothorax pseudaksaiensis* Herzenstein, 1889	Cyprinidae	VU

[144] Mamilov N.Sh., Khabibullin F.Kh., Ibragimova N.A., Mamilov A.Sh., Kostyuk T.P. Urbanization impact on the rivers in the Almaty city// Ecology and safety – 2014. – 8 – P.194-204
[145] Mamilov NS, Mitrofanov IV, Balabieva GK, Khabibullin FK, Mamilov AS, Ibragimova NA. Indigenous fish species in the modern ichthyofauna of the Balkhash basin// Front. Mar. Sci. (Conference Abstract: XV European Congress of Ichthyology). 2015. doi: 10.3389/conf.fmars.2015.03.00043
[146] Мамилов Н.Ш., Шарахметов С.Е., Амирбекова Ф.Т., Лопатин О.Е., Магда И.Н., Кегенова Г.Б.,. Сапаргалиева Н. С., Ургенишбаева Ж. И, Турсынали М.Т. Рыбное население малых рек Балхашского бассейна (Центральная Азия, Республика Казахстан) // Труды Института биологии внутренних вод им. И.Д. Папанина РАН. 2023. - Вып. 101(104). – С.57-68. DOI: 10.47021/0320-3557-2023-57-68

S.No.	Common Name	Scientific Name	Family	IUCN Category v2024-2
5	Scaleless Osman	*Gymnodiptychus dybowskii* (Kessler, 1874)	Cyprinidae	LC
6	Tibetan Stone Loach	*Triplophysa stoliczkai* (Steindachner, 1866)	Nemacheilidae	LC
7	Severtsov's Loach	*Nemacheilus sewerzowi* G. Nikolsky, 1938	Nemacheilidae	VU
8	Grey Stone Loach	*Triplophysa dorsalis* (Kessler, 1872)	Nemacheilidae	LC
9	Spotted Stone Loach	*Triplophysa strauchii* (Kessler, 1874)	Nemacheilidae	LC
10	Plain Thicklip Loach	*Triplophysa labiata* (Kessler, 1874)	Nemacheilidae	VU
11	Balkhash Perch	*Perca schrenkii* Kessler, 1874	Percidae	LC
Alien Species				
12	Caspian Roach	*Rutilus caspicus* (Jakowlew, 1870)	Cyprinidae	LC
13	Chinese False Gudgeon	*Abbottina rivularis* (Basilewsky, 1855)	Cyprinidae	LC
14	Topmouth Gudgeon	*Pseudorasbora parva* (Temminck et Schlegel, 1846)	Cyprinidae	LC
15	Common Bream	*Abramis brama orientalis* Berg, 1949	Cyprinidae	LC
16	Rosy Bitterling	*Rhodeus ocellatus* (Kner, 1865)	Cyprinidae	DD
17	Crucian Carp	*Carassius gibelio* (Bloch, 1782)	Cyprinidae	LC
18	Eurasian Carp	*Cyprinus carpio* Linnaeus, 1758	Cyprinidae	LC
19	Sharpbelly	*Hemiculter leucisculus* (Basilewsky, 1835)	Cyprinidae	LC
20	Wels Catfish	*Silurus glanis* Linnaeus, 1758	Siluridae	LC
21	Chinese Rice Fish	*Oryzias sinensis* Chen, Uwa, Chu, 1999	Adrianichthyidae	LC
22	Eurasian Pikeperch	*Sander lucioperca* (Linnaeus, 1758)	Percidae	LC

S.No.	Common Name	Scientific Name	Family	IUCN Category v2024-2
23	*Micropercops cintus*	*Micropercops cintus* (Dabry et Thiersant, 1872)	Eleotridae	LC
24	*Rhinogobius cheni*	*Rhinogobius cheni* Nichols, 1931	Gobiidae	DD
25	Northern Snakehead	*Channa argus* (Cantor, 1842)	Channidae	LC

Sources: [149],[150],[151],[152]

6.6.4 CRITICAL HABITAT ASSESSMENT

A Critical Habitat assessment was undertaken in accordance with the provisions of the IFC PS6 paragraph 16. Critical habitats are areas with "high biodiversity value", including:

- Habitat of significant importance to Critically Endangered and/or Endangered species;
- Habitat of significant importance to endemic and/or restricted-range species;
- Habitat supporting globally significant concentrations of migratory species and/or congregatory species;
- Highly threatened and/or unique ecosystems; and/or
- Areas associated with key evolutionary processes.

Critical Habitat may not be limited to pristine or highly biodiverse areas, but rather may include both modified habitat and natural habitats across the broader landscape that supports the biodiversity values that trigger the Critical Habitat criterion.

The screening process against the paragraph 16 criteria is informed by the additional guidance provided in GN69 to 97 of the 2019 update of the 2012 guidance. **Table 6-94** details the quantitative qualifying requirements for Criteria 1 to 3 (i.e. thresholds). The likely qualifying interests for Criteria 4 and 5 are subject to research and expert opinion. The criteria listed have been used to complete this assessment.

[149] Мамилов Н.Ш., Шарахметов С.Е., Амирбекова Ф.Т., Лопатин О.Е., Магда И.Н., Кегенова Г. Б., Сапаргалиева Н. С., Ургенишбаева Ж. И., Турсынали М. Т. Рыбное население малых рек Балхашского бассейна (Центральная Азия, Республика Казахстан)// Труды Института биологии внутренних вод им. И.Д. Папанина РАН. 2023. - Вып. 101(104). – С.57-68. DOI: 10.47021/0320-3557-2023-57-68

[150] Мамилов Н.Ш., Линник А.С., Костюк Т.П. Факторы антропогенного влияния на ихтиофауну водоемов бассейна реки Или Международный экологический форум по проблемам устойчивого развития Или-Балхашского бассейна. Тезисы докладов. – Алматы. 2000. С.49-50

[151] Мамилов Н.Ш., Линник А.С., Бедненко О.Г., Ибраев С.М. Изменения ихтиофауны рек Большая Алматинка и Малая Алматинка в условиях усилившейся антропогенной нагрузки// Вестник КазГУ, серия экологическая, 2001, №2(9), с.79-83.

[152] Mamilov N.Sh., Balabieva G.K., KoishybaevaG.S. Distribution of alien fish species in small waterbodies of the Balkhash basin// Russian Journal of Biological Invasions – 2010. - Vol.1. -№3. – P.181-186.

TABLE 6-94: CRITICAL HABITAT CRITERIA

Criteria	Threshold
Criterion 1: Critically Endangered (CR) / Endangered (EN) species:	a) Areas that support globally-important concentrations of an IUCN Red-listed EN or CR species (0.5 % of the global population AND 5 reproductive units of a CR or EN species); b) Areas that support globally-important concentrations of an IUCN Red-listed VU species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in (a). c) As appropriate, areas containing nationally/regionally-important concentrations of an IUCN Red-listed EN or CR species.
Criterion 2: Habitat of significant importance to endemic and/or restricted-range species;	a) Areas that regularly hold ≥ 10 % of the global population size AND ≥ 10 reproductive units of a species.
Criterion 3: Habitat supporting globally significant concentrations of migratory species and/or congregatory species;	a) Areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 % of the global population of a migratory or congregatory species at any point of the species' lifecycle. b) Areas that predictably support ≥ 10 % of the global population of a species during periods of environmental stress.
Criterion 4: Highly threatened and/or unique ecosystems; and/or	a) Areas representing ≥ 5 % of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN. b) Other areas, not yet assessed by IUCN, but determined to be of high priority for conservation by regional or national systematic conservation planning.
Criterion 5: Areas associated with key evolutionary processes	No set threshold

Source: IFC, 2019
Notes: Restricted range/ Endemic Species = Species with global distributions of less than 50,000km^2; Migratory species = Any species of which a significant proportion of its members cyclically and predictably move from one geographical area to another (including within the same ecosystem); Congregatory Species = Species whose individuals gather in large groups on a cyclical or otherwise regular and/or predictable basis.

The complete critical habitat assessment table is provided in **Appendix D**. A summary of the assessment of critical habitat are discussed further in this section.

Delineating an EAAA

For the purposes of this assessment, ERM used the IFC PS6 Guidance Note to define an area of assessment for the Project. Under the IFC PS6, an Ecologically Appropriate Area of Analysis (EAAA) is an area that delineates the extent to which a proposed action or project directly impacts the surrounding biodiversity. The presence of species of conservation significance (e.g. threatened species) influences the size and location of an EAAA. Key factors that assist in delineating EAAAs include the distribution of species or ecosystems (within and sometimes extending beyond the project's AoI based on habitat contiguity) and the ecological patterns, processes, features, and functions that are necessary for maintaining them. These boundaries may include landscape or geological features.

Habitat characterisation facilitated the identification of various habitats with potential to support species of conservation significance. It also considered habitat connectivity and the presence of wildlife corridors in the landscape. Furthermore, the screening of species of conservation significance guided the likelihood of these species being present, particularly those identified as potential critical habitat candidates.

In the context of the project and presence of important biodiversity values, the EAAA has been defined separately for:

- **Migratory and congregatory species**: The Sorbulak Lake System Important Bird Area (IBA) and natural wetland habitat along the alignment have been included. The Sorbulak Lake System lies approximately 5km north of the alignment. The railway passes through the southern portion of an IBA for around 4km. Based on site observations and analysis of Google Earth imagery, it was concluded that for the IBA there are no interactions between the project and the lake systems. Small water bodies south of the alignment were found to be dry and lacked the necessary habitat to support large numbers of migratory or congregatory species that may potentially move from the lake system. The lake system at the northern section of the EAAA supports ≥1% of the global populations of the species for which the Sorbulak Lake Systems KBA/IBA is designated for. The EAAA contains limited suitable habitat along the project alignment, which may occasionally support limited or accidental individuals. As the project is not located in the habitat type within the CH that is associated with migratory waterbirds, it is not expected to have any significant residual impacts on these CH values. Although the project (including the OHTL) is not in CH for these species, given they may be passing through the airspace of the OHTL, the project will implement related mitigation measures including the bird diverters and insulation to avoid and minimize impacts on bird species that are at risk of collision and electrocution.
- **Terrestrial mammalian fauna**: Field observations and consultations with local subject matter experts indicate that large mammal movements, such as those of ungulates, are highly unlikely in this region. Species that may potentially use the larger habitat and be present at the project site include Red fox (*Vulpes vulpes*) [LC (IUCN v2024-1)], Corsac fox (*Vulpes corsac*) [LC (IUCN v2024-1)], Yellow ground squirrel (*Spermophilus fulvus*) [LC (IUCN v2024-1)], Red-cheeked ground squirrel (*Spermophilus erythrogenys*) [LC (IUCN v2024-1)], and various rodents such as the Great gerbil (*Rhombomys opimus*) [LC (IUCN v2024-1)]. These species are categorised as Least Concern and have wide distributions. The project's AoI encompasses mainly of modified agricultural land and pastureland, that constitute contiguous and widespread habitat within the larger landscape.
- **Central Asian Tortoise**: This species prefers sandy habitats with abundant herbaceous vegetation over dense loamy and rocky soils and is mostly found in loess piedmont plains and adyrs, particularly in habitats with ephemeral and ephemeral-wormwood plant

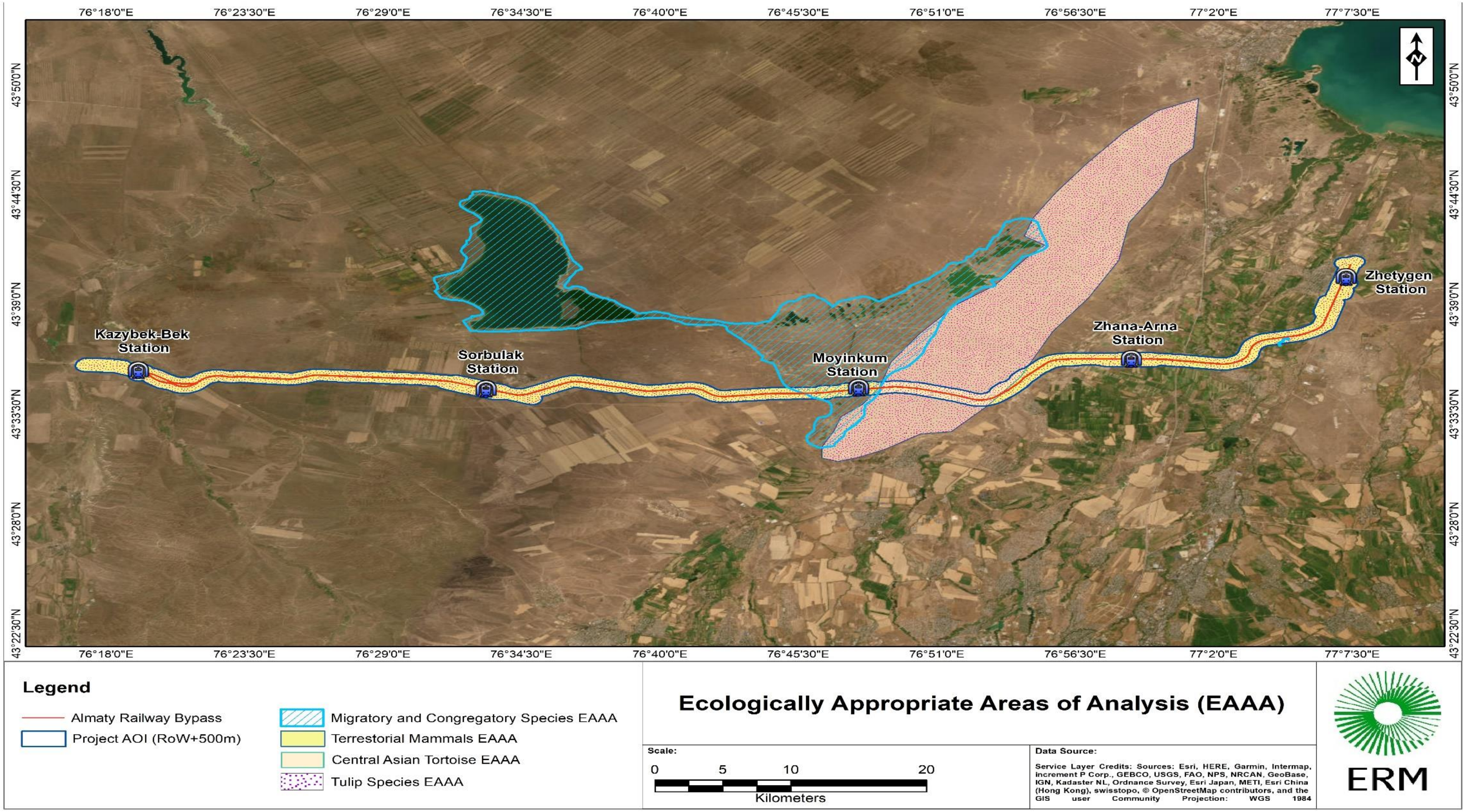
communities[153]. The project's AoI contains semi-desert sand dune habitats, where consultations revealed that Central Asian tortoises were encountered during excavation and construction due to their tendency to burrow in sandy or loamy soils for hibernation or shelter. As a result, this continuous habitat, extending beyond the project AoI, has been considered part of the EAAA for this species.

- **Tulip species**: Species distributed in this region include *Ixiolirion tataricum*, *Rhinopetelum karelinii*, *Tulipa buhseana*, and the endemic *Tulipa behmiana*. These species are wide-ranging across Kazakhstan and are typically found in desert, semi-desert, and steppe habitats with sandy and clay patches. Given their widespread distribution and the extensive preferred habitat in the region, the semi-desert landscape extending beyond the AoI and the project AoI has been included as part of the EAAA for these species.

The EAAA for the Project is depicted in **Figure 6-37**.

[153] Bondarenko, D. A., & Duisebaeva, T. N. (2011). Central Asian Cherepacha, Agrionemys horsfieldii (Gray, 1844), in Kazakhstan (Distribution, range zoning, population density). Main Center of Hygiene and Epidemiology of the Federal Medical and Biological Agency, Russia; Institute of Zoology of the Ministry of Education and Science of the Republic of Kazakhstan.

FIGURE 6-37: ECOLOGICALLY APPROPRIATE AREA OF ANALYSIS (EAAA)



Critical Habitat Criterion 1: Critically Endangered and/or Endangered Species

The Critically Endangered (CR) and Endangered (EN), as classified by IUCN, are species at high risk of extinction and thus have been given an elevated level of consideration under Criterion 1 in IFC PS6. A list of CR and EN species with potential of occurrence within 50km radius of the Project site was generated through IBAT. IBAT considers the historic distribution ranges of the species and presents an indicative list for further assessment. Additionally, VU species were also assessed. A total of two (2) critically endangered, eight (8) endangered and 17 vulnerable species were assessed.

Subsequently, through a combination of desk-based assessments and primary surveys, the CR/EN/VU species were analysed for potential critical habitat candidacy. This assessment incorporated updated knowledge on these species and their current distribution, aiming to ensure thorough consideration of their conservation status.

<u>Based on the assessment, no species has been identified as a likely trigger for critical habitat within the EAAA under Criterion 1.</u>

Critical Habitat Criterion 2: Endemic or Restricted Range Species

Endemic or restricted range species are species that occur within a limited distribution and/or with specific habitat requirements. These species are at a heightened risk of extinction due to their habitat and range requirements and have an elevated level of consideration under Criterion 2 within IFC PS6. For terrestrial vertebrates and plants, a restricted-range species is defined as those species that have an Estimated Extent of Occurrence (EOO) less than 50,000 km^2. IBAT identified three (3) restricted range species from the EAAA.

<u>Based on the assessment, no species has been identified as a likely trigger for critical habitat within the EAAA under Criterion 2.</u>

Critical Habitat Criterion 3: Migratory and/or Congregatory Species

Migratory species spend a portion of their time in different locations throughout the world, depending on wintering and breeding habitat requirements. Whereas congregatory species are defined as species that meet globally significant numbers at a particular place at a certain time of year for feeding, breeding or resting. These species are at a heightened risk of extinction due to habitat and population requirements.

The review of secondary sources including IBAT was carried out to confirm the presence of migratory and/or congregatory species within the AoI and the EAAA. Consultations with government officials, subject matter experts, primary survey and secondary literature review confirmed the presence of some of the species provided by ebird and IBAT in the EAAA, namely, Mallard (*Anas platyrhynchos*, LC), Eurassian Coot (*Fulica atra*, LC), Great Crested Grebe (*Podiceps cristatus*, LC), Black-necked Grebe (*Podiceps nigricollis*, LC), Great Cormorant (*Phalacrocorax carbo*, LC), Grey Heron (*Ardea cinerea*, LC), Great White Egret (*Ardea alba*, LC) etc.

While the Sorbulak lake system at the northern section of the EAAA support ≥1% of the global populations of the species for which the Sorbulak Lake Systems KBA/IBA is designated for. <u>The EAAA contains limited suitable habitat along the project alignment, which may occasionally support limited or accidental individuals not in sufficient numbers to cross the</u>

quantitative threshold of Criterion 3. As the project is not located in the habitat type within the CH that is associated with migratory waterbirds, it is not expected to have any significant residual impacts on these CH values. Although the project (including the OHTL) is not in CH for these species, given they may be passing through the airspace of the OHTL, the project will implement related mitigation measures.

Critical Habitat Criterion 4: Highly Threatened or Unique Ecosystems

Criterion 4 looks at habitats which are at risk of significantly decreasing in area or quality, with a small spatial extent and/or containing unique assemblages of species including assemblages or concentrations of biome-restricted species. The assessment of Criterion 4 was based on habitat types described in **Section 6.6.3.1.**

The project's AoI primarily consists of modified agricultural land, pastureland, and patches of natural semi-desert habitat—forming part of a contiguous and widespread landscape—these habitats are unlikely to represent more than 5% of the global extent of semi-desert habitat. Therefore, threshold 4a would not be exceeded. While these areas have not been formally assessed by the IUCN, they are not considered to be of high priority for conservation, therefore are not likely critical habitat.

Critical Habitat Criterion 5: Key Evolutionary Processes

IFC PS6 describes this Criterion trigger to be one of the following:

- Physical features of a landscape that might be associated with particular evolutionary processes (for example isolated areas, areas of high endemism, spatial heterogeneity, environmental gradients, edaphic interfaces, biological corridors or sites of demonstrated importance to climate change adaptation); and/or
- Subpopulations of species that are phylogenetically or morphogenetically distinct and may be of special conservation concern given their distinct evolutionary history. The latter includes evolutionarily significant units and evolutionarily distinct and globally endangered species.

There are no physical features within the EAAA that are known to be associated with evolutionary processes. The natural semi-desert habitat part of the EAAA constitute a small portion of the contiguous and widespread habitat and has been impacted by anthropogenic activities like vehicular movement and livestock grazing. Furthermore, the species assessments did not identify any species subpopulations known to be phylogenetically or morphogenetically distinct to be relying on the habitat of the EAAA. The EAAA cannot be categorised to have any of the above-mentioned features. So based on the assessment, no physical features or species have been identified as likely triggering critical habitat within the EAAA under Criterion 5.

The assessment concludes that there are no critical habitat values in the defined EAAAs. The biodiversity values that have been subject to the critical habitat assessment are priority BD values to which PS6 Natural Habitat requirements will apply. Based on our screening and assessment, priority biodiversity values are the Common Hamster (IUCN Red List – Critically Endangered), Severtsov's Loach, Plain Thicklip Loach, Seven River's Minnow, Central Asian Tortoise, Asian Houbara, European turtle dove (all IUCN Red List – Vulnerable), and the endemic tulip species, *Tulipa buhseana* (IUCN Red List-Not Evaluated), migratory waterbirds like the White headed duck, Common Pochard and raptors like Palla's fish eagle, Steppe eagle, as well as the semi desert and riparian habitats.

The complete critical habitat assessment table is provided in **Appendix D.**

6.6.5 POTENTIAL SOURCES OF IMPACTS

Based on the potential impacts assessed during the scoping phase of the assessment and subsequent review, the following types of impacts were identified as relevant to the Project:

- **During Construction**
  - Habitat Loss and Modification: Construction activities, including excavation, embankment creation, and clearing of vegetation, are anticipated to lead to direct loss and alteration of habitats. These changes may disrupt species composition and ecological connectivity, and affect local biodiversity, particularly for species reliant on habitats within the AoI.
  - Introduction and Proliferation of Invasive Alien Species (IAS): Construction-related disturbances, coupled with the movement of materials and equipment, increase the risk of introducing and propagating IAS. IAS may outcompete native flora and fauna, potentially leading to long-term degradation of local ecosystems and biodiversity.
  - Impacts on Aquatic Ecology: Bridge construction, earthworks, soil stockpiles, and activities near water bodies are expected to degrade surface water quality by increasing runoff, sedimentation, and erosion. Soil transport and disturbances in or near water will further elevate turbidity and introduce pollutants. The resulting sedimentation may degrade aquatic habitats within the AoI, affecting species that use these habitats. Reduced light penetration and primary production could disrupt ecosystem balance, leading to cascading effects on higher trophic levels. Altered fish prey-predator dynamics, impaired feeding efficiency, and potential growth and reproduction constraints may further impact aquatic species. Additionally, sediment accumulation could affect spawning grounds and benthic habitats.
- **During Operations**
  - Wildlife Mortality Risk with Railway Infrastructure: The movement of trains poses a risk of collision with terrestrial fauna, particularly mammals and avian species that traverse or utilise habitats near the railway alignment. Small terrestrial species, including rodents and reptiles, may become trapped in gaps between rails or other infrastructure, resulting in localised mortality.
  - Habitat Fragmentation, Degradation and Wildlife Barriers: While large-scale fragmentation is not anticipated, minor disruptions to habitat continuity could affect local movements of different species utilising the AoI and larger contiguous habitat. These barriers may lead to reduced resource access. Operational activities may primarily influence behaviour and habitat use of species within the vicinity. Light, noise, and vibration are expected to have localised and transient impacts rather than long-term population-level effects.
  - Collison and Electrocution Risk with the T-Line: Transmission lines pose a well-documented risk of bird mortality due to collision and electrocution, affecting migratory and soaring species such as bustards, vultures and raptors. Collisions are primarily associated with thin earth (shield) wires, which have low visibility, especially during

adverse weather conditions, and can disrupt population dynamics and flyway patterns. While high-voltage transmission lines (220kV and above, as in the case of the project 1.9km 220kV line) generally pose a lower electrocution risk due to wider conductor spacing, large-winged species like vultures and raptors remain vulnerable to electrocution if they bridge live components.

6.6.6 ASSESSMENT CRITERIA

Significance Criteria

The ERM Impact Assessment standard defines sensitivity of ecological receptors by determining the resource sensitivity for species and habitat separately. The habitat and species impact assessment criteria are given in **Table 6-95** and **Table 6-96** respectively.

TABLE 6-95: HABITAT IMPACT ASSESSMENT CRITERIA

Habitat Sensitivity/ Value		Magnitude of Effect on Baseline Habitats			
		Negligible	**Small**	**Medium**	**Large**
		Effect is within the normal range of variation	Affects only a small area of habitat, such that there is no loss of viability/ function of the habitat	Affects part of the habitat but does not threaten the long-term viability/ function of the habitat	Affects the entire habitat, or a significant portion of it, and the long-term viability/ function of the habitat is threatened.
Negligible	Habitats with negligible interest for biodiversity.	**Not significant**	**Not significant**	**Not significant**	**Not significant**
Low	Habitats with no, or only a local designation / recognition, habitats of significance for species listed as of Least Concern (LC) on IUCN Red List of Threatened Species, habitats which are common and widespread within the region, or with low conservation interest based on expert opinion.	**Not significant**	**Not significant**	**Minor**	**Moderate**
Medium	Habitats within nationally designated or recognised areas, habitats of significant importance to globally Vulnerable (VU) Near Threatened (NT), or Data Deficient (DD) species, habitats of significant importance for nationally restricted range species, habitats supporting nationally significant concentrations of migratory species and / or congregatory species, and low value habitats used by species of medium value.	**Not significant**	**Minor**	**Moderate**	**Major**
High	Habitats within internationally designated or recognised areas; habitats of significant importance to globally Critically Endangered (CR) or Endangered (EN) species, habitats of significant importance to endemic and/or globally restricted-range species, habitats supporting globally significant concentrations of migratory species and / or congregatory species, highly threatened and/or unique ecosystems, areas associated with key	**Not significant**	**Moderate**	**Major**	**Critical**

Habitat Sensitivity/ Value		**Magnitude of Effect on Baseline Habitats**			
		Negligible	**Small**	**Medium**	**Large**
		Effect is within the normal range of variation	Affects only a small area of habitat, such that there is no loss of viability/ function of the habitat	Affects part of the habitat but does not threaten the long-term viability/ function of the habitat	Affects the entire habitat, or a significant portion of it, and the long-term viability/ function of the habitat is threatened.
	evolutionary species, and low or medium value habitats used by high value species.				

TABLE 6-96: SPECIES IMPACT ASSESSMENT CRITERIA

Baseline Species Sensitivity/ Value		**Magnitude of Effect on Baseline Species**			
		Negligible	**Small**	**Medium**	**Large**
		Effect is within the normal range of variation for the population of the species	Effect does not cause a substantial change in the population of the species or other species dependent on it	Effect causes a substantial change in abundance and/or reduction in distribution of a population over one, or more generations, but does not threaten the long term viability/ function of that population dependent on it.	Affects entire population, or a significant part of it causing a substantial decline in abundance and/or change in and recovery of the population (or another dependent on it) is not possible either at all, or within several generations due to natural recruitment (reproduction, immigration from unaffected areas).
Negligible	Species with no specific value or importance attached to them.	**Negligible**	**Negligible**	**Negligible**	**Negligible**
Low	Species and sub-species of LC on the IUCN Red List, or not meeting criteria for medium or high value.	**Negligible**	**Negligible**	**Minor**	**Moderate**
Medium	Species on IUCN Red List as VU, NT, or DD, species protected under national legislation, nationally restricted range species, nationally important numbers of migratory, or congregatory species, species not meeting criteria for high value, and species vital to the survival of a medium value species.	**Negligible**	**Minor**	**Moderate**	**Major**
High	Species on IUCN Red List as CR, or EN. Species having a globally restricted range (i.e. plants endemic	**Negligible**	**Moderate**	**Major**	**Critical**

Baseline Species Sensitivity/ Value		Magnitude of Effect on Baseline Species			
		Negligible	Small	Medium	Large
		Effect is within the normal range of variation for the population of the species	Effect does not cause a substantial change in the population of the species or other species dependent on it	Effect causes a substantial change in abundance and/or reduction in distribution of a population over one, or more generations, but does not threaten the long term viability/ function of that population dependent on it.	Affects entire population, or a significant part of it causing a substantial decline in abundance and/or change in and recovery of the population (or another dependent on it) is not possible either at all, or within several generations due to natural recruitment (reproduction, immigration from unaffected areas).
	to a site, or found globally at fewer than 10 sites, fauna having a distribution range (or globally breeding range for bird species) less than 50,000 km2), internationally important numbers of migratory, or congregatory species, key evolutionary species, and species vital to the survival of a high value species.				

6.6.7 IMPACT ASSESSMENT

6.6.7.1 CONSTRUCTION PHASE

This section outlines the potential ecological impacts associated with the construction phase of the railway alignment.

TABLE 6-97: SUMMARY OF IMPACTS DURING THE CONSTRUCTION PHASE

Impact Description	Project Phase	Receptor	Impact Significance (prior to mitigation or with existing mitigation)	Proposed Mitigation Measures	Mitigation Hierarchy Action	Residual Impact Significance
Habitat loss/ fragmentation	Land preparation/ construction	Natural Semi-desert habitat	Moderate	General recommendations for construction phase (ref. Page 287 for details)	Avoidance/ Minimisation	Minor
Habitat loss/ fragmentation	Land preparation/ construction	Natural Riverine habitat	Moderate	Vegetation Clearance Sediment control and monitoring General recommendations for construction phase (ref. Page 287 for details)	Minimisation/ Compensation	Minor
Habitat loss/ fragmentation	Land preparation/ construction	Threatened reptilian species	Moderate	Fencing and barrier Rescue and rehabilitation General recommendations for construction phase (ref. Page 287 for details)	Minimisation	Minor
Habitat loss/ fragmentation	Land preparation/ construction	Other species of conservation importance	Minor	General recommendations for construction phase (ref. Page 287 for details), compensation of loss of natura habitat see mitigation for operation phase	Avoidance/ Minimisation	Negligible

Impact Description	Project Phase	Receptor	Impact Significance (prior to mitigation or with existing mitigation)	Proposed Mitigation Measures	Mitigation Hierarchy Action	Residual Impact Significance
Introduction and Proliferation of Invasive Alien Species	Land preparation/ construction	Natural Habitats in the AoI	Minor	To prevent IAS spread, the project will assess existing IAS, source materials responsibly, train personnel, restrict access, clean equipment, and prioritise native species in restoration, with ongoing monitoring. (ref Page 293 for details)	Minimisation	Negligible
Impacts on aquatic ecology	Land preparation/ construction	Aquatic habitats: Rivers and waterbodies	Moderate	Implement silt controls, routine inspections, and water quality monitoring at key locations. Track dissolved oxygen, TSS, turbidity, and pH, comparing upstream and downstream data. Adjust measures as needed. (ref. Page 296)	Minimisation	Minor
Impacts on aquatic ecology	Land preparation/ construction	Species of conservation importance utilising the aquatic habitat	Minor	The mitigation measures to mitigate impacts on aquatic habitats will suffice in addressing impacts on associated species.	-	Negligible

Impacts due to construction activities including habitat loss and modification

The site preparation activities will require clearance of vegetation which leads to direct impact (vegetation loss) on the habitat and species. Although the Project is situated mostly in modified habitat steppe/pastureland and agriculture land and on limited natural semi-desert habitat, the clearance of vegetation for various activities such as excavation for construction of the railway line, quarries and ancillary facilities, access/internal roads will cause loss of habitat and loss of connectivity of wildlife. This will directly affect the floral diversity and will lead to habitat loss and habitat disturbances to faunal species that the area harbours. It may affect the availability of nesting habitat, breeding sites, foraging resources, and perching habitat for the wildlife in the area. There is also potential for fall and entrapment of different reptilian species and other small and medium sized mammal species using the habitat in excavated areas and quarries.

Based on the tree survey inventory conducted by ALLGEO LLP in 2024, a total of 12,220 trees are identified for felling across four districts: Zhambyl (827 trees), Karasai (892 trees), Ili (9,920 trees), and Talgar (802 trees). The impacted species include *Crataegus L*. (Hawthorn; NE), *Ulmus densa* Litv. (Frequent Elm; NE), *Ulmus pumila* L. (Tree Elm; LC), *Tamarix ramosissima* (Zhyngyl; LC), *Lonicera* L. (Ushqat), *Calligonum* L. (Zhuzgun), *Salix* L. (Buta tal), *Elaeagnus* L. (Jide), *Haloxylon ammodendron* (Saksaul; LC), and *Populus alba* L. (Akterek; LC). The floral inventory conducted in April 2024, validated through primary surveys, confirms that the majority of these trees are plantations (single or row plantations) with low biodiversity value, primarily serving as snowbreaks. The inventory also notes that most of these trees received maintenance during their juvenile stage, including summer-autumn watering, pruning of dry branches, and weeding around the trunks. The only natural vegetation identified are small patches of riparian trees along river crossings and waterbodies in the AoI, consisting mainly of *Ulmus densa Litv*. (Frequent Elm; NE), *Ulmus pumila L*. (Tree Elm; LC), and Elaeagnus sp. (Russian Olive; LC) which are all IUCN least concern species or not evaluated. The alignment intersects multiple rivers across various locations, with one section crossing a natural riverine habitat characterised by extensive reed beds (43°37'20.50"N, 77° 4'47.64"E). This habitat provides suitable breeding and roosting conditions for several passerine species, including Common chiffchaff (*Phylloscopus collybita*) [LC (IUCN v2024-1)], Coal Tit (*Periparus ater*) [LC (IUCN v2024-1)], Great Tit (*Parus major*) [LC (IUCN v2024-1)] as well as for wetland-associated species such as Common Coot (*Fulica atra*) [LC (IUCN v2024-1)], Common Moorhen (*Gallinula chloropus*) [LC (IUCN v2024-1)], Eurasian Bittern (*Botaurus stellaris*) [LC (IUCN v2024-1)], Little Grebe (*Tachybaptus ruficollis*) [LC (IUCN v2024-1)], Black-necked Grebe (*Podiceps nigricollis*) [LC (IUCN v2024-1)] etc. The surrounding vegetation primarily consists of Russian Olive (*Elaeagnus angustifolia*; LC). Furthermore, construction activities near water bodies and natural drainage channels can impact surface water quality due to surface water runoff during site clearance, preparation, and foundation work. During the construction of the bridges and culverts, increased turbidity was observed and may persist temporarily, which will lead to a deterioration of the habitat conditions of aquatic organisms. It is also possible to potentially contaminate surface water and bottom sediments with petroleum products from operating and maintenance equipment.

Embedded Controls

According to the Model Rules for the Creation, Maintenance, and Protection of Green Spaces in Settlements, approved under Order No. 62 (2023) by the Minister of Ecology and Natural Resources of Kazakhstan, compensatory planting for felled trees and shrubs must be carried out where ten (10) times the number of trees lost are replanted. In March 2024, discussions were held with the Inspectorate of Forestry and Wildlife of Almaty Oblast regarding KTZ's obligation to conduct a tree inventory and develop a project outlining the number of trees to be felled and the replantation strategy post-construction. The replantation project will be submitted to the Inspectorate and subsequently reviewed by the Committee of Forestry and Wildlife, which grants the necessary permit. It was noted that the requirement to plant ten (10) trees for each one removed applies only to urban areas and settlements, not to the railway alignment. KTZ is only required to replant trees along both sides of the railway route. According to the National EIA and the floral inventory this involves planting deciduous seedlings of at least 2.5m in height, with a trunk diameter of no less than 3cm (measured at 1.3m from the ground). For the Zhambyl, Karasai, Ili, and Talgar districts, the total number of plantings required amounts to 125,410, comprising 104,610 trees and 20,800 shrubs. Specific distributions include 8,270 plantings in Zhambyl, 8,920 in Karasai, 100,200 in Iliy, and 8,020 in Talgar. In areas near the railway, shrubs like Zhuzgun must be planted with a 50m setback from the rails for safety concerns.

To ensure the survival of these plantations, maintenance and protection measures must be carried out for a three-year period. Should the planted seedlings fail to survive, replanting will have to be carried out. Planting is typically required within a 1km radius of the felling site. If this is not feasible due to lack of space, the authorized body will designate alternate public lands for planting, with implementation carried out by a landscaping organisation. It is recommended to avoid planting near or over the buried 10kV line to prevent root damage and ensure safety. Additionally, planting should not occur directly under any Overhead Lines (OHLs), as this may cause interference with power infrastructure and pose risks to both vegetation and the electrical system.

Impact Magnitude and Significance

The construction activities are expected to convert 0.1349km^2 of riverine habitat and 0.518 km^2 of semi-desert habitat within the RoW. These habitats are known to support species of conservation significance, including Central Asian Tortoise (*Agrionemys horsfieldii*) [VU (IUCN v2024-1)] and Eastern Steppe Viper (*Vipera renardi*) [NT (IUCN v2024-1)]. During the primary surveys, Steppe Eagle (*Aquila nipalensis*) [EN (IUCN v2024-1)] was consistently observed daily within the AoI.

Additionally, primary surveys recorded two Vulnerable species: Common Pochard (*Aythya ferina*) [VU (IUCN v2024-1)] and European Turtle-dove (*Streptopelia turtur*) [VU (IUCN v2024-1)], alongside eight Near-Threatened species, including Black-tailed Godwit (*Limosa limosa*) [NT (IUCN v2024-1)], Ferruginous Duck (*Aythya nyroca*) [NT (IUCN v2024-1)], and Little Bustard (*Tetrax tetrax*) [NT (IUCN v2024-1)]. Secondary data reports four Endangered species from the larger habitat with a potential of rare occurrence in the AoI, namely Egyptian Vulture (*Neophron percnopterus*) [EN (IUCN v2024-1)], Pallas's Fish-eagle (*Haliaeetus leucoryphus*) [EN (IUCN v2024-1)], Saker Falcon (Falco cherrug) [EN (IUCN v2024-1)], and White-headed Duck (*Oxyura leucocephala*) [EN (IUCN v2024-1)]. Vulnerable species reported include Asian Houbara (*Chlamydotis macqueenii*) [VU (IUCN v2024-1)] and Eastern Imperial Eagle (*Aquila heliaca*) [VU (IUCN v2024-1)].

The AoI has reports of species of raptors, with 12 species observed during surveys. This includes species such as Cinereous Vulture (*Aegypius monachus*) [NT (IUCN v2024-1)], Pallid Harrier (*Circus macrourus*) [NT (IUCN v2024-1)], and Short-toed Snake-eagle (*Circaetus gallicus*) [LC (IUCN v2024-1)]. Furthermore, wetland-associated migratory species were documented, with 24 of 38 reported species observed during the surveys. Observations include the Vulnerable Common Pochard (*Aythya ferina*) [VU (IUCN v2024-1)] and Near-Threatened species such as Marbled Teal (*Marmaronetta angustirostris*) [NT (IUCN v2024-1)].

Given the temporary and localized nature of the construction activities, the impacts are anticipated to affect only a small portion of the habitat. Based on the habitat and species impact assessment criteria, the habitat sensitivity is classified as **Medium**, with the magnitude of effect on baseline habitats assessed as **Medium** as there is estimated loss of 0.13 km^2 of riverine habitat and 0.51 km^2 of semi-desert habitat within the Right of Way (RoW). Consequently, the overall impact significance for habitat is rated as **Moderate**.

Considering the presence of species of conservation concern, the baseline species sensitivity is also **Medium.** The Central Asian Tortoise may face population disruption due to project activities, though long-term population viability is not expected to be affected. Encounters with tortoises during excavation, particularly during their hibernation period, highlight potential disruptions to behavioural ecology and an increased risk of accidental mortality. As a result, the magnitude of effect is assessed as **Medium** for reptiles and **Minor** for other species, leading to an overall impact significance of **Moderate to Minor**.

Mitigation Measures

To ensure the effective implementation of the recommended biodiversity mitigation measures, a Biodiversity Management Plan (BMP) is developed, detailing mitigation measures, monitoring protocols, and responsibilities. It is recommended for the Project team to hire an ecologist to oversee the implementation of proposed mitigation measures. The ecologist will oversee and monitor the application of these measures, ensure the BMP is executed as planned, and suggest updates based on site-specific observations and findings. The recommended mitigation measures are presented in **Table 6-98**.

TABLE 6-98: RECOMMENDED MITIGATION MEASURES DURING CONSTRUCTION

Recommendation	Details Measure
Fencing and Barrier[154]	• Fencing Placement: Temporary fencing should be installed only where strictly necessary, particularly around active quarries and large trenches, to mitigate fall and entrapment risks for target species. • Prompt Removal: Fencing must be removed immediately once it is no longer needed to prevent the creation of unnecessary barriers that disrupt wildlife movement. • Fence Height & Structure: The height of the fence should not exceed 1.2 meters (4 feet) to ensure that medium-sized mammals, such as foxes, can see the barrier clearly and avoid injury. • Buried Mesh: To prevent species such as foxes and the Central Asian tortoise from burrowing underneath, the fence must include a buried component. Bury the fence at least 30 cm (12 inches) below ground, angled outward at 90 degrees, to block animals from digging beneath the structure. • The lower portion of the fence should be smooth and free of sharp edges to prevent the Central Asian tortoise from becoming trapped or injured. Regular inspections should be conducted to ensure no animals are caught along the base of the fence. • Visibility Markers: High-visibility markers (e.g., flags or reflective materials) should be incorporated at regular intervals to enhance the visibility of the fencing for wildlife and reduce the risk of accidental collisions. • Wildlife Escape Ramps: Provide escape ramps or graded areas around trenches and quarries, allowing tortoises and other wildlife to exit safely if they become trapped within fenced areas. • Structural Integrity: The fence should be constructed using sturdy materials to maintain upright positioning and reduce the risk of collapse. Loose fencing materials or posts can impede wildlife movement and should be avoided. • Maintenance Schedule: A routine maintenance schedule must be established, including adequate budget provisions to ensure the long-term functionality of the fence. Deterioration of the structure can result in wildlife injuries or mortality, so prompt repairs are essential. • Monitoring: Excavations shall be inspected daily for trapped animals. Additionally, regular monitoring shall be conducted to assess the overall effectiveness of the fencing and adjust mitigation measures as needed based on observed wildlife interactions with the structure. • Vehicle Speed Limits: All vehicles operating in the fenced areas should adhere to a maximum speed limit of 20 km/h to minimise the risk of wildlife-vehicle collision.

[154] Convention on the Conservation of Migratory Species of Wild Animals (CMS) and Central Asian Mammals Initiative (CAMI). (2020). Mitigating the impact of linear infrastructure on migratory mammals in Central Asia: Guidelines and recommendations. Wildlife Conservation Society. https://www.cms.int/sites/default/files/publication/cms-cami_pub_linear-infrastructure_wcs_e.pdf

Recommendation	Details Measure
Vegetation clearance	• Tree Inventory Assessment: Conduct a comprehensive tree inventory prior to any tree felling activities. Document the species and size of all trees within the project area to facilitate informed decision-making during felling and future restoration activities. • Timing of Felling Activities: Schedule tree felling activities outside the autumn migratory season and the breeding season for local avian fauna whenever feasible. This minimises disruption to migratory patterns and nesting behaviours of birds. • Pre-Felling Inspection: Engage a qualified local ecologist, naturalist, or an organisation with expertise in local biodiversity to conduct inspections of all trees designated for felling. Assess the trees for the presence of avifauna nests, mammals, herpetofauna, and any other fauna that may inhabit the trees. • Monitoring for Fauna Presence: If the presence of mammals, herpetofauna, birds, or bats is detected, postpone tree felling or transplanting until the animal vacates the tree voluntarily. Implement a waiting period if necessary to ensure the animal has left the area. • Protection of Active Nests: Ensure that if active nests are identified on any tree, the nests remain undisturbed until nesting activities are complete, meaning the young have fledged. Tree felling or transplanting should only be conducted after verifying that no active nests are present. • Post-Felling Fauna Inspection: Following tree felling, a qualified individual (ecologist/naturalist) or organisation should thoroughly inspect the fallen tree for any injured or trapped fauna that may have gone unnoticed. If any injured or trapped animals are found, provide immediate veterinary care as needed. • Documentation and Reporting: Maintain records of all inspections, findings, and actions taken regarding tree felling, including any incidents involving wildlife. This documentation should be made available for future reference.
Rescue and rehabilitation procedure	A detailed procedure should be developed, outlining steps to manage wildlife incidents within the project area. Staff must undergo regular training to ensure familiarity with the rescue and rehabilitation protocols in place. • Animal Entrapment or Presence on Site: If an animal is found trapped in an excavated area, encountered accidently (e.g., Central Asian tortoises, which were found during the current excavation due to their tendency to burrow in sandy or loamy soils for hibernation or shelter) or enters the project site, the local wildlife and forestry department should be contacted immediately to initiate a formal rescue. Untrained personnel should be prohibited from approaching or attempting to rescue animals, even if the animal appears distressed, as this may cause harm to both the animal and staff. • Incident Documentation and Reporting: A detailed log must be maintained for all wildlife encounters, including animals that become trapped, are accidentally discovered, or are observed during construction activities. Akimats should be kept informed of any wildlife encounters. The log should capture the species involved/observed, the condition of the animal, the date, time, and exact location of the incident/observation, as well as any relevant circumstances. Photographic evidence should be collected where possible. This information must be promptly reported to the Project Manager, Construction Superintendent or Senior Environment or HSE Manager (or equivalent). Additionally, consultation with the local wildlife department or subject matter experts should be initiated as required.

Recommendation	Details Measure
	• Involvement of Project Personnel in Rescues: Project personnel may only participate in rescue operations if requested by the local wildlife department, and any actions taken must be under their direct supervision and guidance. The client may also consider identifying a local ecology expert to assist with rescue efforts. • Health and Safety Protocols: Any project staff involved in handling animals, whether for rescue or disposal of deceased animals, must use appropriate personal protective equipment (PPE) such as disposable gloves and masks. Given the prevalence of rabies in the region, all personnel handling animals should be vaccinated and thoroughly briefed on associated risks. After handling animals, staff must wash and sanitize their hands thoroughly. o Post-Incident Protocol: ▪ Follow-Up: The Senior Environment / HSE Manager (or equivalent) must follow up with the Forest Department or a veterinarian to monitor the condition of the rescued animal and confirm the date of its release back into the wild. ▪ Incident Investigation: The Senior Environment / HSE Manager (or equivalent) will investigate incidents that result in injury or death of wildlife. The investigation should include the following steps: • Interview workers or eyewitnesses present on the site to gather observations. • Identify the activities that could have led to the injury or death of the animal. • If the injury is linked to project activities, determine and implement corrective actions to prevent future occurrences in coordination with the Process Senior Executive. ▪ Dissemination of Corrective Actions: The Senior Environment / HSE Manager (or equivalent) should communicate the corrective actions to all staff and discuss them during daily meetings to ensure widespread understanding and compliance.
Sediment control and monitoring	• Implement silt fences, sediment traps, or barriers around exposed soil areas and stockpiles to prevent sediment runoff into nearby water bodies. • Ensure that drainage systems are designed and maintained to handle runoff and prevent sediment transport into waterways. • Develop a water quality monitoring and erosion control plan in compliance with regulatory requirements and best practices. • Implement corrective actions if monitoring results indicate elevated sediment levels, such as reinforcing sediment control barriers or adjusting site management practices.
General recommendations for construction phase	• No hunting, trapping or injuring of local fauna should be communicated to the workforce through a workshop or formal training exercise. • Identify sensitive receptors during the tree inventory period (mentioned above) such as breeding grounds, and nearby residential areas. The client may also consider identifying a local ecology expert to identify sensitive receptors.

Recommendation	Details Measure
	• Schedule construction activities to minimise disturbances during critical periods, such as breeding and migratory seasons for local fauna. • Install temporary noise barriers or acoustic screens around construction sites to attenuate sound levels near identified active breeding grounds or nests. • Regularly maintain equipment to ensure optimal performance. • Limit the use of noisy activities to specific times of the day, avoiding early morning and late evening hours. • Continuously monitor noise and vibration levels during construction to ensure compliance with established regulatory thresholds. • Set routes, consolidation of trips and no off-roading policies should be introduced by the EPC contractor to reduce the impact. • Topsoil that is disturbed should be stored separately for later restoration of the habitat for both compensatory afforestation and compensation of loss of natural habitat. • All vehicles transporting loose materials must be covered with tarpaulins to prevent dust spread and material loss. Minimise drop heights during loading/unloading operations. • Native tree/shrub species should be seeded in disturbed areas during the monsoon season. • Simultaneous revegetation with native species should be practiced in areas that are determined to have loose or unstable soil to avoid erosion. • Additional areas in consultation with Forestry and Wildlife Department should be identified where native plantation can be undertaken based on regulatory requirements and best practices. • Hazardous materials should not be stored near natural drainage channels. • Waste materials should be cleared in a timely manner and the use of artificial lights should be minimised to not attract wildlife. • Proper sanitation facilities should be provided at the labour camps. • Labour movement should be restricted between construction camps and construction sites. Labour movement should be restricted in areas where no construction activity is planned. • General awareness regarding fauna should be practiced through training, posters, etc. among the staff and labourers. • It is recommended to avoid planting activities near or over the buried 10kV line to prevent root damage and ensure safety. Additionally, planting should not occur directly under any OHTLs, as this may cause interference with power infrastructure and pose risks to both vegetation and the electrical systems.

Residual Impact Significance

The direct and indirect impacts are limited to the construction phase of the Project. With the proper implementation of the mitigation measures, significance of the residual impact may reduce to **Negligible** for Habitat and **Minor to Negligible** for species.

Summary

The impact significance for habitat loss and modifications due to the construction activities is summarised is **Table 6-99.**

TABLE 6-99: IMPACT SIGNIFICANCE OF HABITAT LOSS AND MODIFICATION ON BIODIVERSITY VALUES

Category	**Impact before Mitigation**	**Impact after Mitigation**
Nature	Negative	
Type	Direct to Indirect	
Duration	Temporary to Short-term	
Extent	Local	
Scale	Limited to construction area and immediate surrounding	
Frequency	During construction phase	
Habitat Significance (Highest Level)	**Moderate**	**Minor**
Species Significance (Highest Level)	**Moderate**	**Minor**

Introduction and Proliferation of Invasive Alien Species

The construction phase of railway projects can inadvertently facilitate the introduction and spread of invasive alien species (IAS) through various pathways. Equipment, materials, and personnel moving between sites may carry IAS through soil, plant matter, or even on clothing[155]. The disturbance of land during construction, such as vegetation clearance, excavation, and the creation of embankments, can create open habitats that favour the growth of IAS or enhance the spread of species already present in the area[156]. Railway embankments and access roads often act as corridors that facilitate the movement of IAS, allowing them to colonise new areas more quickly[157].

These disturbed environments, particularly along railway lines, offer ideal conditions for IAS due to exposed soil, direct sunlight, and reduced competition from native vegetation during early construction phases.

[155] Hulme PE, Bacher S, Kenis M, Klotz S, Kuehn I, Minchin D (2008) Grasping at the routes of biological invasions: a framework for integrating pathways into policy. J Appl Ecol 45:403–414. https://doi.org/10.1111/j.1365-2664.2007.01442.x
[156] ricke, R. M., & Olden, J. D. (2023). Technological innovations enhance invasive species management in the Anthropocene. BioScience, 73(4), 261–279. https://doi.org/10.1093/biosci/biad018
[157] Dębicki, P., & Zawisza, M. (2017). Railway routes as corridors for invasive plant species: The case of NE Poland. ResearchGate. https://www.researchgate.net/publication/313659253_Railway_routes_as_corridors_for_invasive_plant_species_The_case_of_NE_Poland

Embedded Controls

No known embedded controls are known at the time of writing.

Impact Magnitude and Significance

A significant portion of the alignment traverses a mosaic of highly degraded and overgrazed areas, interspersed with some patches of relatively better condition steppe grasslands. These lands are extensively utilised as pasture for local livestock, including sheep, goats, and horses. The area is subject to considerable pressure from grazing, increasing the presence and spread of various IAS. The dominant grass species observed within the AoI belong to the genera *Stipa* and *Festuca.*

The estimated loss of 0.1349 km^2 of riverine habitat and 0.518 km^2 of semi-desert habitat within the Right of Way (RoW) will facilitate IAS spread, further degrading the landscape. The spread of IAS could significantly alter the habitat ecology over time, but the partial habitat loss is not expected to threaten the long-term viability of the ecosystem. Invasive species management by the EPC Contractor may mitigate some of the negative impacts. Consequently, the habitat sensitivity is **Medium** and impact magnitude is **Small**, with a **Minor** overall habitat impact significance.

Based on the tree survey inventory conducted, a total of 12,220 trees are identified for felling across four districts: Zhambyl (827 trees), Karasai (892 trees), Iliy (9,920 trees), and Talgar (802 trees). The impacted species include Crataegus L. (Hawthorn; NE), Ulmus densa Litv. (Frequent Elm; NE), Ulmus pumila L. (Tree Elm; LC), Tamarix ramosissima (Zhyngyl; LC), Lonicera L. (Ushqat), Calligonum L. (Zhuzgun), Salix L. (Buta tal), Elaeagnus L. (Jide), Haloxylon ammodendron (Saksaul; LC), and Populus alba L. (Akterek; LC). Most of these floral species are IUCN least concern species. Additionally, the faunal species utilising the Project AoI have alternate habitat availability in the larger landscape minimising significant long-term impacts.

Considering the above and acknowledging the presence of species of conservation concern utilising the habitat, especially herpetofauna, the baseline species sensitivity is classified as **Medium**. The magnitude of the effect on these species is also assessed as **Small**, as this is not expected to undermine the long-term viability or ecological function of the populations reliant on these habitats. Consequently, the overall species impact significance is considered **Minor**.

Mitigation Measures

Although the impact significance is **Minor,** as there are existing IAS on site, the following mitigation measures are recommended to manage any further proliferation of these IAS due to habitat loss and disruption:

- Conduct an assessment to identify existing IAS on site.
- Source fill soil and construction materials from reputable suppliers to minimise the risk of introducing IAS.
- Train personnel on IAS identification and prevention practices, including checking for seeds and plant fragments.
- Limit access to construction sites to essential personnel only and establish designated access routes.

- Where possible machinery and equipment should be cleaned of soil prior to being mobilized to the site. Waste from vehicle washing facilities has the potential to contain seeds or fragments from IAS and should be disposed of appropriately
- Restoration plans, including those for quarry sites such as the one observed, should prioritise the use of native plant species to outcompete IAS.
- Regularly monitor the site for signs of IAS during and after construction.
- Develop the planned restoration activities prioritising the use of native plant species to outcompete IAS.

Residual Impact Significance

The direct and indirect impacts are limited to the construction phase of the Project. With the proper implementation of the mitigation measures, significance of the residual impact may reduce to **Negligible** for Habitat and **Negligible** for species.

Summary

The impact significance for habitat loss and modifications due to the construction activities is summarised is **Table 6-100.**

TABLE 6-100: IMPACT SIGNIFICANCE OF CONSTRUCTION ACTIVITIES ON INTRODUCTION AND PROLIFERATION OF IAS

Category	Impact before Mitigation	Impact after Mitigation
Nature	Negative	
Type	Direct	
Duration	Short-term to Long-term	
Extent	Local	
Scale	Limited to construction area and immediate surrounding	
Frequency	During construction phase	
Habitat Significance (Highest Level)	**Minor**	**Negligible**
Species Significance (Highest Level)	**Minor**	**Negligible**

Impacts on Aquatic Ecology

The railway alignment will intersect the Uzyn Kargaly, Zhyngyldy, Zhamankyul, Kaskelen, Malaya Almatinka, and Karasu Baiserke rivers as well as irrigation canals. These mixed and glacial-fed rivers originate from rainfall and melting glaciers and snow from the Zailiyskiy Alatau mountain range, part of the larger Tian Shan Mountain system. The Karasu Baiserke mostly formed by spring meltwater. These rivers will drain to the Balkhash Basin with floods observed in the summer months. The bypass will intersect five (5) rivers as summarised in **Table 6-60**. A total of 48 culverts are expected to be required for canals and temporary watercourses and for 'balancing' water levels across the railway embankment in areas such as floodplains are summarised in **Table 6-61**. Additionally, the construction activities are expected to convert 0.13 km^2 of riverine habitat.

Bridge construction, earthworks, soil stockpiles, and activities near water bodies are expected to degrade surface water quality by increasing runoff, sedimentation, and erosion. Soil transport and disturbances in or near water will further elevate turbidity and introduce pollutants. The resulting sedimentation may degrade aquatic habitats within the AoI, affecting species that rely on these environments. As detailed in the baseline, a total of 25 fish species have been reported from the AoI and the larger landscape. Among these, five Vulnerable species —Seven River's Minnow (*Phoxinus brachyurus*), Balkhash Marinka (*Schizothorax argentatus*), Ili Marinka (*Schizothorax pseudaksaiensis*), Severtsov's Loach (*Nemacheilus sewerzowi*), and Plain Thicklip Loach (*Triplophysa labiata*) potentially use the aquatic habitats.

Embedded Controls

The National EIA has outlined the following measures to minimise impacts on aquatic habitats:

- Ensure compliance with national laws for activities within protected shoreline belts and water protection zones.
- Implement erosion control measures, such as silt fences and sediment basins, to prevent sediment runoff.
- Restore disturbed areas by backfilling construction quarries, planting vegetation, and sowing perennial grass with mineral fertilisers.
- Prohibit open storage, loading, and transportation of bulk dusty materials; use containers or specialised transport instead.
- Preserve existing vegetation along rivers to filter runoff and reduce sedimentation.
- Apply best practices for hazardous material handling and storage to prevent spills and contamination.
- Dispose of fuel-lubricating materials only at designated locations.
- Collect domestic wastewater in tanks for offsite treatment.
- Conduct site cleanup and landscaping to restore vegetation after construction completion.

Impact Magnitude and Significance

Given the temporary and localized nature of the construction activities, the impacts are anticipated to affect only a small portion of the habitat. Based on the habitat and species impact assessment criteria, the habitat sensitivity is classified as **Medium**, with the magnitude of effect on baseline habitats assessed as **Medium** as there is estimated loss of 0.13 km^2 of riverine habitat within the Right of Way (RoW). Consequently, the overall impact significance for habitat is rated as **Moderate.**

Acknowledging the presence of species of conservation concern utilising the habitat, the baseline species sensitivity is classified as **Medium**. The magnitude of the effect on these species is assessed as **Small**, as construction phase activities are not expected to undermine the long-term viability or ecological function of the populations reliant on these habitats. It is noted that these species have undergone local extirpation, regional declines in the Ili River, and see presence of strongholds in the Lake Balkhash and Lake Alakol basins beyond the AoI. Given their low abundance, declining trends, and limited suitable habitat within the AoI, the overall species impact significance is considered **Minor**.

Mitigation Measures

No additional mitigation measures are required in addition to the recommended measures of the National EIA; however, the following good practices are recommended to manage stormwater, erosion, and water quality during construction:

Stormwater and Erosion Control Plan:

- Implement silt fences, sediment traps, or barriers around exposed soil areas and stockpiles to prevent sediment runoff into nearby water bodies.
- Conduct routine inspections and monitoring, including quarterly culvert checks and regular cleaning.

Water Quality Management Plan:

- Establish a weekly surface water quality monitoring program in compliance with regulatory requirements and best practices.
- Conduct monitoring at locations with prolonged construction activities (e.g., bridge crossings, temporary construction roads with drainage pipes) and at critical social or environmental receptors downstream.
- Measure key water quality parameters, including dissolved oxygen, Total Suspended Solids (TSS), turbidity, and pH.
- Compare upstream and downstream water quality data to assess potential construction-related impacts.
- Implement corrective actions if monitoring results indicate elevated sediment levels, such as reinforcing sediment control measures or adjusting site management practices.

Additionally, previously recommended mitigation measures for vegetation clearance, rescue and rehabilitation should be implemented.

Residual Impact Significance

The direct and indirect impacts are limited to the construction phase of the Project. With the proper implementation of the mitigation measures, significance of the residual impact may reduce to **Minor** for Habitat and **Negligible** for Species.

Summary

The impact significance for aquatic ecology due to the construction activities is summarised is **Table 6-101**.

TABLE 6-101: IMPACT SIGNIFICANCE OF CONSTRUCTION ACTIVITIES ON AQUATIC ECOLOGY AND ASSOCIATED BIODIVERSITY VALUES

Category	Impact before Mitigation	Impact after Mitigation
Nature	Negative	
Type	Direct	
Duration	Short-term to Long-term	
Extent	Local	
Scale	Limited to construction area and immediate surrounding	

Category	Impact before Mitigation	Impact after Mitigation
Frequency	During construction phase	
Habitat Significance (Highest Level)	**Moderate**	**Minor**
Species Significance (Highest Level)	**Minor**	**Negligible**

6.6.7.2 OPERATIONAL PHASE

This section outlines the potential ecological impacts associated with the operation phase of the railway alignment.

TABLE 6-102: SUMMARY OF IMPACTS DURING THE OPERATION PHASE

Impact Description	Project Phase	Receptor	Impact Significance (prior to mitigation or with existing mitigation)	Proposed Mitigation Measures	Mitigation Hierarchy Action	Residual Impact Significance
Wildlife mortality risks	Operation of railways	Threatened reptile species	Moderate	Monitoring of herpetofauna, particularly the Central Asian Tortoise, is recommended during peak activity periods (April-May) to assess movement and collision risks. High-risk sections should incorporate wildlife-friendly fencing to mitigate direct mortality. Underpasses and culverts should be maintained clear of debris to facilitate safe passage. Systematic mortality surveys along the railway should inform adaptive management of mitigation measures. (ref. **Page 301** for details)	Minimisation	Minor
Wildlife mortality risks	Operation of railways	Other species of conservation importance	Minor	Habitat restoration and vegetation buffers near river crossings, with some focus on river and stream beds (see below) are recommended to enhance connectivity for avian and mammalian species. A structured monitoring program should track medium-sized mammals, raptors, and ground-dwelling birds, with surveys aligned to peak activity periods. Wildlife awareness measures, including railway signage and staff training, should be implemented. Mitigation measures should be periodically refined based on monitoring data. (**ref. Page 301** for details)	Minimisation	Negligible
Habitat fragmentation, degradation and wildlife barriers	Operation of railways	Natural habitats in the AoI	Minor	Habitat restoration along the railway corridor should prioritise native vegetation, with invasive species control to prevent spread from maintenance activities. To compensate for loss of 0.139 km ^{2} of riparian habitat, it is suggested that the same area also be restored along river and	Compensation	Negligible

Impact Description	Project Phase	Receptor	Impact Significance (prior to mitigation or with existing mitigation)	Proposed Mitigation Measures	Mitigation Hierarchy Action	Residual Impact Significance
				stream beds to compensate for natural habitat loss in conjunction with facilitating dispersal as described above, Periodic reviews should assess restoration success and wildlife passage effectiveness. Noise mitigation may include soundproofing barriers or dense vegetation (**ref. 304** for details)		
Habitat fragmentation, degradation and wildlife barriers	Operation of railways	Species of conservation importance	Moderate	Habitat restoration and wildlife monitoring (**ref. Page 301 and 304** for details)	Minimisation	Minor
Collision and Electrocution Risks from T-Line	Operation of the T-Line	Threatened and migratory raptors	Moderate	It is recommended to install bird flight diverters on overhead transmission lines, particularly along the PS-Alma-500 and Zhana Arna 1.9km OHTL, ensuring proper spacing for visibility. Insulation should maintain a safe distance between energised parts and likely perches, using tubing or insulating chains as necessary. Perch deterrents should be installed to prevent birds from perching near energized wires. Regular carcass monitoring and disposal protocols should be established, with trained personnel reporting findings. Ongoing raptor population monitoring should be conducted to evaluate the effectiveness of these measures and adjust as needed. (**ref to 308** for details) For any transmission lines which are re-aligned due to the railway alignment, typically under the control of KEGOC (which have credit lines with several multi-lateral lenders), KTZ should influence them to implement the above mitigation measures.	Minimisation	Minor

Wildlife Mortality Risks Associated with Railway Infrastructure

Railway infrastructure poses a range of risks to wildlife, impacting avifauna[158], herpetofauna, and mammals through direct mortality, habitat fragmentation, and behavioural changes. Research highlights that collisions with moving trains are a primary concern. Gregarious avian species traveling in flocks are highly vulnerable, with train strikes often resulting in multiple fatalities during single events[159]. The infrastructure itself, such as power lines, poles, and embankments, attracts birds by providing nesting, perching, or hunting opportunities, especially for raptors[160]. This attraction often increases mortality risks from collisions and electrocution. Additionally, edge effects created by railway corridors alter predator-prey dynamics, with increased predation on nests near transport lines leading to reduced nestling survival and reproductive success[161].

For herpetofauna, including reptiles and amphibians, railway tracks, culverts, and embankments create physical barriers that restrict movement and result in entrapment[162]. Species such as the Central Asian tortoise face localized mortality when trapped in infrastructure gaps, and amphibians are particularly susceptible during seasonal migrations or breeding periods, where railways intersect critical movement routes.

Mammals face both direct collision risks and indirect impacts due to habitat fragmentation. Medium to large mammals, including foxes and ungulates, are more visible in collision records, while smaller mammals often go unnoticed despite frequent mortality[163]. Railway verges, which may offer food and cover, attract mammals and increase their exposure to train strikes.

Embedded Controls

The following embedded measure has been incorporated into the Project:

- The design of the Project includes installation of six (6) cattle crossings along the alignment for safe passage for animals across the railway line and reduce the risk of collisions.

Impact Magnitude and Significance

Most species utilising these habitats are classified as least concern (LC) by IUCN, with alternate habitat availability in the larger landscape minimising significant long-term impacts.

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[158] Barrientos R, Borda-de-Água L. Railways as Barriers for Wildlife: Current Knowledge. In: Borda-de-Água L, Barrientos R, Beja P, Pereira HM, editors. Railway Ecology. Cham: Springer International Publishing; 2017. p. 43–64

[159] Godinho C, Marques JT, Salgueiro P, Catarino L, de Castro CO, Mira A, et al. Bird Collisions in a Railway Crossing a Wetland of International Importance (Sado Estuary, Portugal). In: Borda-de-Água L, Barrientos R, Beja P, Pereira HM, editors. Railway Ecology. Cham: Springer International Publishing; 2017. p. 103–115.

[160] Van Rooyen CS, Ledger JA. Birds and Utility Structures: Developments in Southern Africa. In: Ferrer M, Janns GFE, editors. Birds and Power Lines: Collision, Electrocution, and Breeding. Madrid: Quercus; 1999. p. 205–229

[161] Newmark WD, Stanley TR. Habitat Fragmentation Reduces Nest Survival in an Afrotropical Bird Community in a Biodiversity Hotspot. Proceedings of the National Academy of Sciences. 2011;108(28):11488–11493. doi: 10.1073/pnas.1104955108

[162] Borda-de-Água, L., Barrientos, R., Beja, P., & Pereira, H. M. (2017). Railways as barriers for wildlife: Current knowledge. Frontiers in Ecology and Evolution, 5, Article 21. https://doi.org/10.3389/fevo.2017.00021

[163] de Villiers, M. S. (2023). Factors affecting mammal utilisation of non-wildlife railway underpasses within the Greater Kruger, South Africa. WiredSpace. https://wiredspace.wits.ac.za/items/2f9a3951-a0b5-4e8f-855e-d66f095ed559

However, occasional use by threatened species, such as Central Asian Tortoise (*Agrionemys horsfieldii*) [VU], or ground roosting gregarious species like Little Bustard (*Tetrax tetrax*) [NT], observed as a group of 12 individuals roosting and feeding within the RoW, elevates the habitat sensitivity to **Medium**. The partial habitat loss does not threaten habitat functionality or long-term viability, classifying the impact magnitude as **Medium** and overall habitat impact significance as **Moderate**.

Species more commonly associated with these habitats include Red Fox (*Vulpes vulpes*) [LC], Corsac Fox (*Vulpes corsac*) [LC], Yellow Ground Squirrel (*Spermophilus fulvus*), and Great Gerbil (*Rhombomys opimus*) [LC]. While most species have low vulnerability due to their adaptability, small-medium sized mammals, threatened raptors, and reptiles are more prone to direct collisions due to their behavioural ecology. For instance, ground-dwelling reptiles are at higher risk due to infrastructure gaps, and raptors and other avian and mammal species have direct collision risks.

Design interventions, such as cattle crossings, mitigate some collision impacts. Additionally, the absence of wildlife corridors, congregatory sites, or species of conservation importance in high density reduces the overall species sensitivity to **Medium**. For Central Asian Tortoise, the impacts could alter population disruption across generations but remain unlikely to threaten long-term population viability. The magnitude of effect is thus assessed as **Medium** for reptiles and **Small** for other species, resulting in an overall **Moderate-to-Minor** impact significance.

Recommended Mitigation Measures

- Establish vegetation buffers near river crossings to enhance habitat connectivity for avian and small mammal species. There should be some focus on river and stream beds so that in addition to facilitating habitat connectivity, the loss of 0.139 km^2 of loss of natural habitat is also addressed. More details for implementing this action and monitoring towards no net loss of provided in the BMP.
- Maintain underpasses and culverts free of debris to ensure their continued use by wildlife.
- Develop a wildlife monitoring plan for target species like herpetofauna, medium sized mammals and raptor and ground dwelling avifauna.
    - After the beginning of the railway operations, and to get a good evaluation of mortality estimates, monitoring should cover a minimum period of three (3) years.
    - Prioritise surveys during peak activity periods, such as dispersal, migration, and breeding seasons, ensuring temporal alignment with species-specific activity cycles. For example: for Central Asian Tortoise schedule surveys during active months (April-May) to capture data on movement and collisions, avoiding inactive periods (winter hibernation and summer aestivation).
    - Implement systematic mortality surveys along railway tracks, recording carcass locations, species, and suspected causes of death.
    - Use transect-based observations to detect live animals and their behaviours near railway infrastructure.
    - Train railway staff and local communities to report wildlife incidents, creating an incident reporting protocol for timely response and analysis.

- Based on monitoring results, the mitigation plan should be updated regularly to address emerging risks, ensure the effectiveness of measures, and refine the approach according to species-specific needs.

- Based on construction and operation monitoring data if there are any high-risk sections implement physical barriers such as wildlife fencing along those sections of the railway to reduce direct collisions, particularly for small mammals, reptiles, and birds.
- Install clear signage along the railway to raise awareness among train operators regarding wildlife presence and potential collision risks. This can help enhance vigilance during critical periods when wildlife activity is high.
- Provide training for all relevant railway personnel on wildlife risk awareness, collision reporting, and how to handle wildlife sightings or accidents.
- In areas with high wildlife activity, consider adding wildlife friendly low-level lighting to tracks, especially near wildlife crossing points. This may enhance the visibility of animals at night and reduce collision risks, particularly for nocturnal species.

Residual Impact Significance

The direct and indirect impacts are limited to the operation phase of the Project. With the proper implementation of the mitigation measures, significance of the residual impact may reduce to **Minor** for Habitat and **Minor** for species.

Summary

The impact significance for wildlife mortality risks associated with railway infrastructure during operations is summarised is **Table 6-103.**

TABLE 6-103: IMPACT SIGNIFICANCE OF RAILWAY OPERATIONS ON WILDLIFE MORTALITY RISKS

Category	Impact before Mitigation	Impact after Mitigation
Nature	Negative	
Type	Direct	
Duration	Short-term to Long-term	
Extent	Local	
Scale	Limited to railway corridor and immediate surroundings	
Frequency	Operational phase	
Habitat Significance (Highest Level)	**Moderate**	**Minor**
Species Significance (Highest Level)	**Moderate**	**Minor**

Habitat fragmentation, degradation and wildlife barriers

During the operation stage of a railway project, habitat degradation will be primarily driven by disturbances such as noise, light exposure from passing trains, and pollution, including emissions from maintenance equipment and increased vehicular traffic along access roads. These disturbances can significantly affect wildlife by causing behavioural changes and, in some cases, driving species away from their habitats. Noise and light, in particular, are known to disrupt breeding and feeding activities, with some bird species even abandoning nests and nestlings.

Vegetation cover may also be impacted by environmental pollution, notably emissions from railway and motor vehicles and the use of anti-icing reagents on the railway tracks during winter. These chemicals can cause soil salinisation, which negatively impacts plant growth by altering soil chemistry, reducing growth rates, and causing morphological changes in vegetation.

Railway lines contribute to habitat fragmentation by acting as barriers to animal movement and population connectivity. The physical infrastructure of the railway divides continuous ecosystems into smaller, isolated patches, which can reduce available habitat and impede migration, feeding, and breeding activities for wildlife. While railways are often impassable for non-flying species, even flying species can be impacted, especially if the rail corridors intersect with migration routes[164]. The noise, vibration, and light exposure from trains further disturb wildlife, creating barriers to movement and occupation of adjacent areas, and potentially affecting behavioural patterns. These disruptions not only restrict access to resources but can alter long-term species dynamics, impeding reproductive success and limiting habitat availability over time.

The cumulative effect of these barriers and disturbances can lead to disrupting ecological processes. Railways generally have a narrower footprint than roads, which may result in less severe fragmentation in some regions, although the overall effects on wildlife vary widely by species and railway characteristics[165].

Embedded Controls

- Monitoring the flora health along the railway line to assess any long-term impacts from railway activities.
- Implementing measures to control and manage invasive plant species that may threaten native flora in the vicinity of the railway line.
- Developing restoration plans post-construction including replanting native species.

Impact Magnitude and Significance

The significance of the impact has been assessed for pastureland, agricultural land, riverine habitat, and semi-desert, which host diverse fauna, including mammals, birds, reptiles, and burrowing animals. No known wildlife corridors or important faunal assemblages exist in the project Aoi. However, the loss of 0.1349km^2 of natural riverine habitat and 0.518km^2 of natural semi-desert habitat within the RoW will result in partial habitat reduction. The habitat found in the project AoI forms part of a larger, contiguous landscape, ensuring that alternative habitat of comparable or higher quality is readily available for species that might be impacted, therefore, the partial habitat loss does not threaten habitat functionality or long-term viability, classifying the habitat sensitivity as **Medium** and impact magnitude as **Small** and overall habitat impact significance as **Minor**.

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[164] Müller, R., & Kelling, A. (2017). Railways as barriers for wildlife: Current knowledge. In Railway Ecology (pp. 43-64). Springer. https://doi.org/10.1007/978-3-319-57496-7_4
[165] Mitigating measures to reduce habitat fragmentation by railway lines in the Netherlands. Retrieved from https://trid.trb.org/view/639949

As previously mentioned, the project AoI lacks known wildlife corridors and does not support large-scale migration patterns for large mammals or congregatory sites for avifauna. However, the area is frequented by medium-sized mammals, with potential occasional sightings of species such as the Goitered Gazelle (*Gazella subgutturosa*), which are recorded about 100km from the AoI towards the Balkhash Lake, using similar habitat[166]. While these species may experience temporary impacts due to habitat fragmentation, the surrounding landscape offers ample alternate habitats, which should enable the species to adjust to these changes over time. Therefore, the fragmentation impact on these species is expected to be short-term and non-critical.

In the operation phase, the most significant impact is likely to be the noise and vibration generated by the railway. These disturbances have been shown to displace local fauna and may have adverse effects on more vulnerable species, such as the Central Asian Tortoise (*Agrionemys horsfieldii*) and endangered species like the Steppe Eagle (*Aquila nipalensis*). Since the railway line is relatively short ~75kms and majorly traverses through modified habitat, noise and vibration impacts may not lead to population declines but may result in temporary displacement or avoidance behavior[167].

In some studies, large bird species, such as raptors, have been observed to avoid areas closer to railways, leading to small reductions in their numbers near the infrastructure, though this effect diminishes with distance from the tracks[168]. For smaller bird species, such as insectivores, the impact appears to be negligible or even positive, with some species attracted to the infrastructure.

Considering the presence of species of conservation concern, such as the Central Asian Tortoise and Steppe Eagle, the baseline species sensitivity is classified as **Medium**. The magnitude of the effect on these species is also assessed as **Medium**, as the operational activities are not expected to undermine the long-term viability or ecological function of the populations reliant on these habitats. Consequently, the overall species impact significance is considered **Moderate.**

Recommended Mitigation Measures

In addition to the mitigation measures recommended previously, the following mitigation measures are recommended:

- Restoring and enhancing the habitat on both sides of the railway line. The restoration should prioritise native vegetation species.
- An Integrated Vegetation Management Plan (IVMP) should be developed for the plantation along the railway corridor, which will require ongoing maintenance and further management during the operational phase. The plan should include the following components:
    - Replanting & Maintenance: If planted seedlings fail to establish, they should be replanted within the first planting cycle. Maintenance and protection should continue for a three-year period to support the growth and survival of the new plantings.

[166] Almaty, KZ · iNaturalist
[167] Scherzinger, G., & Reutlinger, A. (2018). "Species attraction and repulsion: The role of rail infrastructure in biodiversity conservation." Ecological Engineering, 120, 155-163. https://doi.org/10.1016/j.ecoleng.2018.08.016
[168] Gerlach, G., & Rüegg, M. (2020). Impact of railways on avian biodiversity in Central Europe. Journal of Applied Ecology, 57(3), 633-645. https://doi.org/10.1111/1365-2664.13594

  - Monitoring & Reporting: Biannual monitoring should be carried out to assess plant survival rates and overall health. Monitoring should focus on key indicators such as leaf discoloration, pest damage, defoliation, and growth anomalies. A survival benchmark, such as an 80% survival rate, should be set for the monitoring period. Reports should be submitted to the relevant authorities.
  - Health Assessments: A standardized health assessment process should be used, where plants are rated on a scale of healthy, moderate stress, and severe stress. This will allow for early detection of potential issues, such as nutrient deficiencies or environmental stressors.
  - Invasive Species & Pest Management: The IVMP should include specific measures for identifying and controlling invasive plant species and managing pest infestations that may threaten the newly planted vegetation. Non-chemical methods should be prioritised for pest and weed control.
  - Responsibility & Coordination: The responsibility for monitoring and maintaining the plantation should be clearly assigned to the O&M contractors, working in close collaboration with the hired ecologist to ensure the long-term success of the vegetation.
  - Replacement Plan: If plantings do not survive, a replacement strategy should be developed in consultation with the relevant regulatory authorities. Replacement should occur in the first planting season to ensure continuous coverage and ecological restoration.
- Implement control measures for invasive plant species that may be exacerbated by railway maintenance and disturbed soils.
- Identify offset locations and develop an offset management plan to compensate for the riparian natural habitat that has been converted.
- Periodic reviews of habitat restoration success and wildlife passage effectiveness, adjusting strategies as necessary.
- Based on monitoring data (see guidance for wildlife monitoring plan discussed previously) install soundproofing barriers or dense plant cover along sensitive stretches of the railway corridor to absorb sound.
- Prohibit the dumping of all types of waste along the corridor or surrounding areas. Wastes should be segregated by type (e.g., organic, hazardous, recyclable) and transported to designated facilities in nearby townships or cities for safe and responsible disposal.
- Enforce a ban on any activities leading to soil or water contamination, including open burning of any type of waste. Proper waste management systems should be implemented to avoid environmental degradation.
- Prohibit the discharge of any solid or liquid wastes, including wastewater, oils, and cleaning residues, into rivers, streams, or other water bodies. This includes effluents from washing vehicles, equipment, and machinery.
- Implement strategies to limit the use of anti-icing reagents, ensuring that only minimal amounts are applied and that they are properly contained to prevent runoff. Using less toxic de-icing materials such as calcium chloride, phosphate inhibited or calcium magnesium acetate, which do not cause irreversible changes in photosynthesis and subsequent destruction of tissues of plants and animal deaths. Additionally, installation of drainage systems to capture runoff and prevent soil salinisation.

Residual Impact Significance

The direct and indirect impacts are limited to the operation phase of the Project. With the proper implementation of the mitigation measures, significance of the residual impact may reduce to **Negligible** for Habitat and **Minor** for species.

Summary

The impact significance for habitat fragmentation, degradation and wildlife barriers during operations is summarised is **Table 6-104**.

TABLE 6-104: IMPACT SIGNIFICANCE OF RAILWAY OPERATIONS ON HABITAT FRAGMENTATION AND DEGRADATION

Category	Impact before Mitigation	Impact after Mitigation
Nature	Negative	
Type	Direct to Indirect	
Duration	Short-term to Long-term	
Extent	Local	
Scale	Limited to railway corridor and immediate surroundings	
Frequency	Operational phase	
Habitat Significance (Highest Level)	**Minor**	**Negligible**
Species Significance (Highest Level)	**Moderate**	**Minor**

Collison and Electrocution Risks from Transmission Line

The project will utilise three 500/220kV substations: one existing substation at Kazybek Bek, a new substation to be constructed within the Zhana Arna Station footprint, and an additional substation, PS-Alma-500, located outside the RoW. The PS-Alma-500 substation does not belong to KTZ and is not an associated facility for this project. The additional substation will be connected to the proposed Zhana Arna Station via a 1.9km 220 kV OHTL (of which, about 500m is within the Project RoW). Additionally, one (1) single circuit 10 kV underground power transmission line spanning 73km, running parallel to the alignment will be within the Project RoW.

One of the most well-known impacts of transmission line on biodiversity is bird mortality due to collision and electrocution, which represents a major source of anthropogenic mortality and kills hundreds of thousands to millions of birds every year[169,170,171,172]. Several studies suggest

169 Erickson, W.P., Johnson, G.D., Young Jr., D.P., 2005. A Summary and Comparison of Bird Mortality from Anthropogenic Causes with an Emphasis on Collisions, General Technical Reports.
170 Loss, S.R., Will, T., Marra, P.P., 2014. Refining estimates of bird collision and electrocution mortality at power lines in the United States. PLoS One 9, e101565. http://dx.doi.org/10.1371/journal.pone.0101565
171 Loss, S.R., Will, T., Marra, P.P., 2015. Direct mortality of birds from anthropogenic causes. Annu. Rev. Ecol. Evol. Syst. 46, 99–120. http://dx.doi.org/10.1146/annurevecolsys- 112414-054133.
172 Rioux, S., Savard, J.-P.L., Gerick, A.A., 2013. Avian mortalities due to transmission line collisions: a review of current estimates and field methods with an emphasis on applications to the Canadian electric network. Avian Conserv. Ecol. 8. http://dx.doi.org/10.5751/ACE-00614-080207.

that power line collision mortality can have significant population-level impacts[173] [174] [175] and may even congregatory patterns and flyways[176]. Collision frequency is thought to be a contributing factor in on-going population declines in several species of bustards and diurnal raptors[177]. Inappropriately routed and located transmission lines and poor design can potentially have significant impacts upon migratory and soaring birds. The primary threats are collisions and electrocution.

The proposed transmission line project falls under high voltage line (220kV). The design of high voltage power lines (60kV up to 700kV) along a vertical (upward) plane with cables of low visibility is associated with collision risks, especially during adverse weather conditions. Higher collision risk is associated with the thin earth (shield) wire, which is found above the thicker high voltage conductor wire[178]. As these are usually connected to pylons with long suspended insulators, electrocution risk at high voltage power lines is typically low. Medium and low voltage power lines or distribution lines (~1kV to 60kV) are more likely to result in electrocution, due to birds making a connection between two live components. But in a landscape (like project landscape) where larger birds with bigger wingspan (vultures, resident and migratory raptors) are present, risk of electrocution from high Voltage transmission line is be considered.

Embedded Controls

No known embedded controls are known at the time of writing.

Impact Magnitude and Significance

The species, which are susceptible to electrocution and collision, are raptors and occasional wetland associated migratory and congregatory species. A total of 27 raptor species have been recorded in the area, including species of conservation concern such as four Endangered species—Egyptian Vulture (*Neophron percenters*), Pallas's Fish-eagle (*Haliaeetus leucoryphus*), Steppe Eagle (*Aquila nipalensis*) and Saker Falcon *(Falco cherrug*)— two (2) Vulnerable species—Eastern Imperial Eagle (*Aquila heliaca*) and Greater Spotted Eagle (*Clanga clanga*) — and three (3) Near threatened species —Cinereous Vulture (*Aegypius monachus*), Himalayan Griffon (*Gyps himalayensis*) and Pallid Harrier (*Circus macrourus*). Twelve (12) of these species are listed in the Red Data Book of the Republic of Kazakhstan.

The transmission line is going to affect a small portion of available habitat. Moreover, there are no records of large congregatory or roosting sites recorded for the resident and migratory

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173 Loss, S.R., Will, T., Marra, P.P., 2012. Direct human-caused mortality of birds: improving quantification of magnitude and assessment of population impact. Front. Ecol. Environ. 10, 357–364. http://dx.doi.org/10.1890/110251.

174 Schaub, M., Aebischer, A., Gimenez, O., Berger, S., Arlettaz, R., 2010. Massive immigration balances high anthropogenic mortality in a stable eagle owl population: lessons for conservation. Biol. Conserv. 143, 1911–1918. http://dx.doi.org/10.1016/j.biocon.2010.04.047.

175 Schaub, M., Pradel, R., 2004. Assessing the relative importance of different sources of mortality from recoveries of marked animals. Ecology 85, 930–938. http://dx.doi. org/10.1890/03-0012.

176 Palacín, C., Alonso, J.C., Martín, C.A., Alonso, J.A., 2017. Changes in bird-migration patterns associated with human-induced mortality. Conserv. Biol. 31, 106–115. http://dx.doi.org/10.1111/cobi.12758.

177 Guidance on appropriate means of impact assessment of electricity power grids on migratory soaring birds in Rift Valley/Red Sea Flyway. Birdlife International. GEF. UNDP. http://www.migratorysoaringbirds.undp.birdlife.org

178 Guidance on appropriate means of impact assessment of electricity power grids on migratory soaring birds in Rift Valley/Red Sea Flyway. Birdlife International. GEF. UNDP. http://www.migratorysoaringbirds.undp.birdlife.org

vultures in the AoI, since threatened species were recorded during the primary survey the habitat sensitivity has been assessed as **High** and but since the project will only impact a small portion of the available habitat the impact magnitude is considered **Small** and overall habitat impact significance as **Moderate.**

Acknowledging the presence of species of conservation concern utilising the habitat, especially threatened vultures and raptors, the baseline species sensitivity is classified as **High**. The magnitude of the effect on these species is assessed as **Small**, as this is not expected to undermine the long-term viability or ecological function of the populations reliant on these habitats. Consequently, the overall species impact significance is considered **Moderate**.

Recommended Mitigation Measures

Bird Divertors on Transmission Lines

- Bird Diverter Installation: Install bird flight diverters on overhead transmission lines, especially along the PS-Alma-500 and Zhana Arna 1.9km OHTL. Also explore the possibility of installing bird divertors on existing TLs that will be relocated, especially near any waterbodies. These devices should be large and placed 5-10m apart to enhance visibility and reduce collision risks (**Figure 6-40**).
- The installation of these diverters should follow guidelines set by the relevant local authorities.

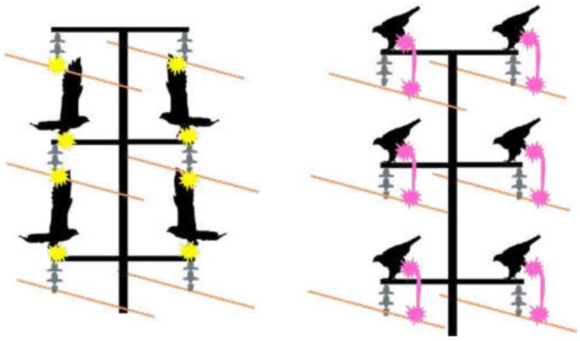
Insulation and Perch Management for Transmission Lines

- Insulation: Poles with suspended insulators should maintain a distance of at least 60cm between a likely perch (cross-arm) to the energized parts (conductors). In instances where the conductors run above or too close to the cross-arm, tubing should be used. Insulating chains of at least 152cm in length (determined based on the average wingspan of common avifauna) should be used for bird-safe strain poles (**Figure 6-38**).
  - Perch management: Cross-arms, insulators and other parts of the power lines can be constructed so that there is no space for birds to perch where they can be close to energized wires. This is often done by using exclusion devices, or perch deterrents (**Figure 6-39**). If cross arms are fitted with deterrents but pole-tops and insulators remain exposed, perching is likely to continue unabated.

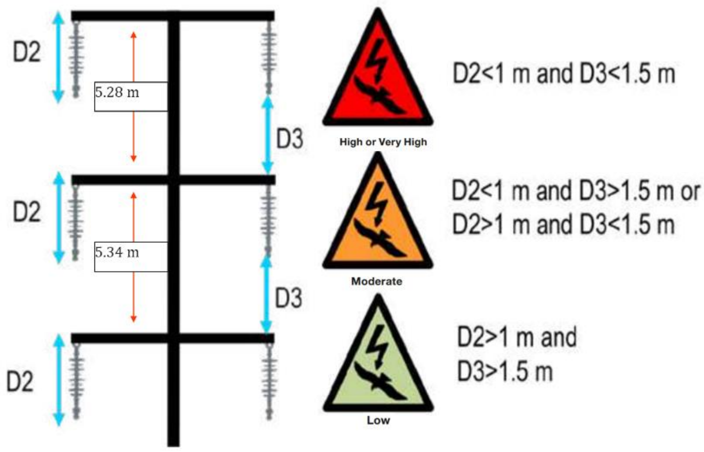
Carcass Monitoring and Reporting

- Carcass Surveys: Implement regular monitoring along the TLs and railway corridor to detect carcasses. The O&M team should be trained to recognize carcasses and report them immediately to the EHS manager. High occurrences of carcasses should trigger an immediate review of potential mitigation measures to ensure the reduction of collision and electrocution risks.
- Carcass Disposal Protocols: Develop clear protocols for the immediate removal and safe disposal of carcasses found near transmission lines or infrastructure. This will help prevent scavenger species from being attracted to high risks areas and reduce the likelihood of collision and electrocution risks.
- Ongoing Monitoring: Conduct long-term monitoring of raptor populations in collaboration with wildlife department to assess the effectiveness of mitigation measures. Data should be shared with local authorities to track trends in bird mortality and refine management strategies, if required.

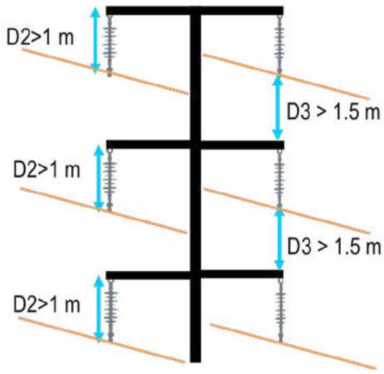
FIGURE 6-38: CROSSARM AND INSULATOR LAYOUTS TO PREVENT ELECTROCUTION



A. **Risk Possibilities:** Phase–earth contact (yellow); Contact through defecation (pink)



B. **Danger level:** Differing danger levels of a cross-arm configuration depending on the basic critical distances[179] (D2 and D3)



C. **Structural Corrective measure:** Safe values of basic critical distances (considering the largest birds that may be electrocuted) to maintain to mitigate the risk of electrocuting

[179] D2- The vertical distance between the point where the bird perches and the nearest live element at a lower level (conductor or jumper). *Depends on the risk caused by defecation and the distance between the bottom of the legs and the tip of a wing spread out downwards*; D3- Vertical distance between the point where the bird perches and the nearest live element at a higher level (conductor or jumper). *Depends on the vertical reach of the bird, i.e. the distance between the foot and the tip of a wing spread out upwards.*

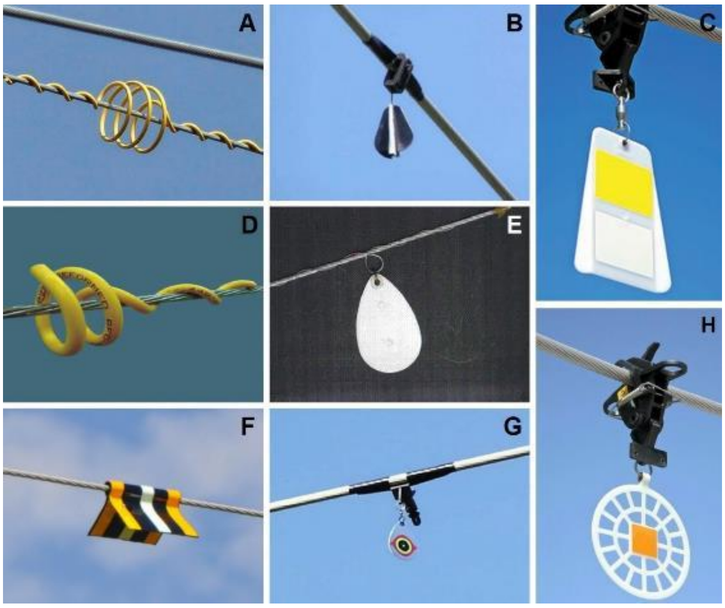
FIGURE 6-39: DIFFERENT TYPES OF PERCH DETERRENTS

	
a. Rigid metal plates	b. Fixed "umbrella-shaped" metal anti-bird spikes
	
c. Combination of anti-perching deterrents	d. Rotating cups with anti-perching extension

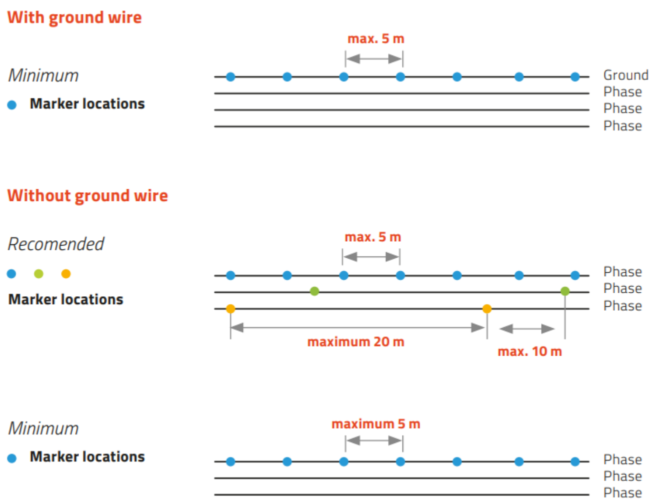
Source: (Martín et al., 2022)[180]

[180] Martín Martín, J., Garrido López, J.R., Clavero Sousa, H. and Barrios, V. (eds.) (2022). Wildlife and power lines. Guidelines for preventing and mitigating wildlife mortality associated with electricity distribution networks. Gland, Switzerland: IUCN.

FIGURE 6-40: DIFFERENT TYPES OF BIRD DIVERTERS AND RECOMMENDED SPACING



A. Different kinds of Diverters: A, Swan Flight Diverter[181]; **B,** Rotating Bird Flapper[182,183]; **C,** Fire-fly Diverter[184]; **D,** Bird Flight Diverter[185]; **E,** Bird Flapper; **F,** Power Line Markers[186]; **G,** Bird Diverter and **H,** Bird Mark Flapper[187]



B. Recommended spacing between markers, taking into account the presence of ground wires

[181] Gális, M., & Ševčík, M. (2019). Monitoring of effectiveness of bird flight diverters in preventing bird mortality from powerline collisions in Slovakia. Raptor Journal, 13(1), 45-59.
[182] Murphy, R. K., Dwyer, J. F., Mojica, E. K., McPherron, M. M., & Harness, R. E. (2016). Reactions of Sandhill Cranes approaching a marked transmission power line. Journal of Fish and Wildlife Management, 7(2), 480-489.
[183] Ferrer, M., Morandini, V., Baumbusch, R., Muriel, R., De Lucas, M., & Calabuig, C. (2020). Efficacy of different types of "bird flight diverter" in reducing bird mortality due to collision with transmission power lines. Global Ecology and Conservation, 23, e01130.
[184] Gális, M., & Ševčík, M. (2019). Monitoring of effectiveness of bird flight diverters in preventing bird mortality from powerline collisions in Slovakia. Raptor Journal, 13(1), 45-59.
[185] Gális, M., & Ševčík, M. (2019). Monitoring of effectiveness of bird flight diverters in preventing bird mortality from powerline collisions in Slovakia. Raptor Journal, 13(1), 45-59.
[186] Murphy, R. K., Dwyer, J. F., Mojica, E. K., McPherron, M. M., & Harness, R. E. (2016). Reactions of Sandhill Cranes approaching a marked transmission power line. Journal of Fish and Wildlife Management, 7(2), 480-489.
[187] Dashnyam, B., Purevsuren, T., Amarsaikhan, S., Bataa, D., Buuveibaatar, B., & Dutson, G. (2016). Malfunction rates of bird flight diverters on powerlines in the Mongolian Gobi. Mongolian Journal of Biological Sciences, 14(1-2), 13-20.

Residual Impact Significance

The direct and indirect impacts are limited to the operation phase of the Project. With the proper implementation of the mitigation measures, significance of the residual impact may reduce to **Minor** for Habitat and **Minor** for species.

Summary

The impact significance for collision and electrocution risks during operations is summarised is **Table 6-105.**

TABLE 6-105: IMPACT SIGNIFICANCE OF COLLISION AND ELECTROCUTION RISKS DUE TO OPERATION OF THE PROJECT T-LINE

Category	Impact before Mitigation	Impact after Mitigation
Nature	Negative	
Type	Direct to Indirect	
Duration	Short-term to Long-term	
Extent	Local	
Scale	Limited to railway corridor and immediate surroundings	
Frequency	Operational phase	
Habitat Significance (Highest Level)	**Moderate**	**Minor**
Species Significance (Highest Level)	**Moderate**	**Minor**

6.7 GREENHOUSE GAS ASSESSMENT

6.7.1 APPLICATION OF LEGISLATION, POLICY AND GUIDELINES

Applicable laws, directives, policy, standards and guidance are used to assess the impacts of climate change are outlined in **Table 6-106**.

TABLE 6-106: CLIMATE CHANGE APPLICABLE GUIDELINES

Title	Year
Standards	
IFC Performance Standards on Environmental and Social Sustainability	2012
GHG Protocol Corporate Account and Reporting Standard	2004 (revised in 2013)
Guidance	
IPCC GHG inventory guidelines for mobile, stationary combustion, and wastewater treatment	2006

6.7.1.1 ENVIRONMENTAL CODE OF THE REPUBLIC OF KAZAKHSTAN

Chapter 9 of the Environmental Code of the Republic of Kazakhstan sets out regulations with regards to greenhouse gas emissions. Under the code, operators of projects that emit more than 20,000 tonnes of CO_2e in regulated areas (oil and gas, electricity, mining, metallurgical, chemical, processing in the production of building materials – cement, lime, gypsum and brick) are required to obtain quotas before operation.

As this project does not fall under any of the regulated areas, we have deemed that the code does not apply to this project.

6.7.2 GREENHOUSE GAS EMISSION SCOPES DEFINITION

The GHG Protocol establishes an international standard for accounting and reporting greenhouse gas (GHG) emissions. Under the GHG Protocol, emissions are divided into three 'scopes':

- Scope 1 emissions: Direct GHG emissions; defined as those emissions that occur from sources that are owned or controlled by the reporting entity or project.
- Scope 2 emissions: A category of indirect emissions that accounts for GHG emissions from the generation of purchased energy products (principally electricity from the Almaty electricity grid) by the project during operational phase. For the Project, this includes energy purchased for day to-day operations at the facility including machinery and equipment. It is anticipated that the facility will utilise electricity from the national grid, which is predominantly generated by coal power plants, and will have material Scope 2 emissions.
- Scope 3 emissions: Those emissions that are a consequence of the activities of an entity, but which arise from sources not owned or controlled by the Company. Examples of Scope 3 activities include extraction and production of purchased materials, transportation of purchased fuels, and use of sold products and services.

6.7.3 ASSESSMENT METHODOLOGY

The IFC Performance Standards state that "for projects that are expected to or currently produce more than 25,000 tonnes of CO_2e annually, the client will quantify direct emissions from the facilities owned or controlled within the physical project boundary as well as indirect emissions associated with the off-site production of energy used by the project".

Upon initial assessment, it was ascertained that this project is expected to directly produce more than 25,000 tonnes of CO_2e annually, largely due to the Scope 2 emissions of purchased electricity. Thus, there is a need to quantify direct emissions from the project.

Whilst Scope 3 (indirect) emissions from sources such as purchased goods and services, disposal of waste and use of sold products by third parties may be significant, these are not required to be included in the GHG emissions boundary under the IFC Performance Standards and are therefore excluded from this analysis.

Table 6-107 presents the initial screening of GHG emission sources involved in the Project's construction and operation phases for inclusion in the GHG inventory. Information was taken from the Environmental Impact Assessment titled "Report about possible impacts to the details design "Construction of a bypass railway line bypassing the railway junction of the Almaty Station. Adjustment", documents and responses requested from KTZ. Should there be significant changes in the information provided or assumptions made, or agreed assessment criteria as the project develops (e.g. detailed engineering design), the elements of this assessment and associated management, mitigation, and monitoring measures may need to be updated to reflect those changes.

The results from the GHG assessment in this report may not reflect the true quantity of emissions of the Project, as some GHG sources that might be significant are screened out due to the lack of information at the time writing this report.

TABLE 6-107: SCREENING OF KEY GHG EMISSIONS SOURCES FOR ASSESSMENT

Emissions Source	Construction	Operations
Vegetation Clearing	The project location is located in a desert and semi-desert climate with hot, dry summers and cold winters. Desert-steppe vegetations are observed within the project area. 12,220 trees are identified for felling across four districts: Zhambyl (827 trees), Karasai (892 trees), Ili (9,920 trees), and Talgar (802 trees). No information about hectares of vegetation cleared was provided. However, emissions from this source may be material hence ERM has taken some assumptions for calculation and screened this source in.	No vegetation clearance is necessary during the operations phase and therefore this source is screened out.
Methane gas venting	During construction, there is a one-time event of gas venting at the intersection of the bypass railway with the main gas pipeline owned by AGP LLP Methane makes up 97% of the gas vented during this process hence this source is screened in.	There is no gas venting during the operations phase and thus this source is screened out.

Emissions Source	Construction	Operations
Mobile Combustion – Fuel (on- and off-road)	Various types of on- and off-road construction and transportation vehicles are involved in construction (e.g. truck crane, self-propelled motor platform, crew bus, manipulator and loader) and are likely to give rise to significant GHG emissions. It is likely that fuel consumption data for some construction equipment is missing, however we believe we have been provided the majority of data.	To our knowledge, no on-road or off-road vehicles will be used in the operational stage of the project and therefore this source is screened out.
Stationary Consumption – Liquified Petroleum Gas (LPG)	LPG is used for rotational camp's boiler room for hot water and space heating needs.	LPG is used in the boiler room for hot water and space heating needs.
Stationary Consumption – Diesel	Diesel is used for the air compressor, bitumen boiler, wielding units, mobile diesel power plant and diesel generator.	Diesel is used as back up fuel for the boiler room, the diesel generator and manoeuvring a diesel locomotive.
Purchased Electricity	No grid electricity will be used during the construction stage and therefore this source is screened out.	Electricity will be imported from the Almaty electricity grid for the operation of the electrified railway track and buildings.
Air-conditioning / refrigeration	No information is available at this stage on the types of such systems. Therefore, the amount of hydrofluorocarbon (HFC) could not be calculated. In any case, this is expected to be an immaterial source and is therefore screened out.	
On-site solid waste treatment	Treated by third party and will be considered Scope 3 emissions and hence screened out.	
On-site wastewater treatment	A licensed third party will collect and treat domestic wastewater during construction. Therefore, this is a scope 3 emission and screened out.	At Zhetygen, Zhana Arna Sorbulak, Kazybek Bek Station and the Moyinkum junction, the locations will adopt onsite treatment plants. There was no information available at this stage on specifications of these plants. In any case, this is expected to be an immaterial source and is therefore screened out.
Fugitive SF_6 used in switchgears	No fugitive SF_6 losses during the construction phase are expected and therefore this source is screened out.	There is an electrochemical protection system, and it is noted that SF_6 will be used for insulation for switchgears. There will be a RU-10 kV switchgear at Zhana Arna substation. There will be 27.5 kV outdoor switchgear and 10 kV switchgear at the existing Kazybek Bek substation, however no potential SF_6 gas capacity or

Emissions Source	Construction	Operations
		capacity of SF_6 refills was provided, hence this is screened out
Fugitive CO_2 from extinguisher systems	It is not clear whether chemical fire extinguishers will be use. In any case, this is expected to be an immaterial source and is therefore screened out.	

Note: Green-filled cells are screened in GHG sources. Yellow-filled cells are screened out sources at this stage due to lack of information, but the GHG emissions from these could be significant. Red-filled cells are screened-out sources.

Based on the analysis above, the Project's reportable GHG emission sources and their scope are described in **Table 6-108.**

TABLE 6-108: SCREENED-IN GHG EMISSION SOURCES

Activity	Scope
Construction phase	
Vegetation Clearing	Scope 1
Methane Gas Venting	Scope 1
Mobile combustion – Diesel and Petrol/Motor Gasoline (on- and off-road)	Scope 1
Stationary combustion – Liquified Petroleum Gas and Diesel Oil	Scope 1
Operation phase	
Stationary combustion - Liquified Petroleum Gas and Diesel Oil	Scope 1
Purchased Electricity	Scope 2

6.7.4 CARBON FOOTPRINT ACCOUNTING

The carbon footprint is the estimated GHG emissions produced directly and indirectly by an individual, organisation, facility, or product. The calculation of a carbon footprint generally involves the following equation:

EQUATION 6-1: CARBON FOOTPRINT

$$Carbon\ Footprint\ Emissions = Activity\ Data\ \times Emissions\ Factor\ \times Global\ Warming\ Potential$$

In which:

- Activity Data relates to the emission-causing activity of the Project, e.g. the quantity of diesel or LPG that is combusted.
- the Emission Factor (EF) converts the activity data from a physical quantity into an amount of GHGs. This value varies depending on the sources of GHG emissions and what standards were used.
- Global Warming Potentials (GWP) is a measure of the total energy that a gas absorbs over a specified period of time (usually 100 years), compared to carbon dioxide (unit: tonnes

CO_2e). The GWP values (see **Table 6-109**) are taken from the IPCC Sixth Assessment Report[188].

TABLE 6-109: 100- YEAR GWP VALUES

GHG	GWP values	Unit
Carbon dioxide (CO_2)	1	ton CO_{2e} / ton CO_2
Methane (CH_4)	29.8	ton CO_{2e} / ton CH_4
Nitrous oxide (N_2O)	273	ton CO_{2e} / ton N_2O

To get the activity data and EF values for inputting into **Equation 6-1**, further calculations may be needed that will involve a higher level of data complexity, and this will depend on the GHG emission sources. The methodologies that are used to obtain activity data and EF values for each source is described further below.

6.7.4.1 TIERS

The IPCC uses "tiers" (from 1 to 3) to rate the reliability and methodological complexity of emission factors and activity data. It is good practice to report tiers for all emission sources included in the inventory. Tier 1 is the basic method, frequently utilising IPCC-recommended country-level defaults; Tier 2 involves country-specific data; while Tier 3 involves Project-specific data. The higher the tier rank (i.e., higher number 3), the higher quality data is needed for the assessment. Therefore, this report prioritises the use of EF and activity data of tier 3 as much as possible, and where data is not available, tier 2 and tier 1 methods will be used.

6.7.5 ASSESSMENT METHODOLOGY – CONSTRUCTION PHASE

This next section describes the methods and data inputs that will be used to estimate the Project's carbon emissions.

6.7.5.1 VEGETATION CLEARING

The IPCC[189] provides guidance on estimating carbon stock changes in grassland remaining grassland (GG) for two carbon pools: living biomass and soils. Since there were no GHG related soil data provided, ERM focused on quantifying living biomass clearance for the project. 12,220 trees are identified for felling across four districts: Zhambyl (827 trees), Karasai (892 trees), Ili (9,920 trees), and Talgar (802 trees). Information about area of vegetation cleared in hectares was not provided which means estimation of CO_2 from carbon fraction and amount of biomass will be challenging. Since the emissions from this source may be material for the construction phase, ERM has taken some high-level assumptions for a simple calculation according to **Equation 6-2** and screened this source in.

Equation 6-2: CO2 emissions from the felling of trees

$$Annual\ CO_2\ emissions\ = Total\ biomass\ \times Carbon\ Fraction\ \times \frac{44}{12}$$

[189] Intergovernmental Panel on Climate Change (IPCC). (2003). *Good practice guidance for land use, land-use change and forestry.* In IPCC National Greenhouse Gas Inventories Programme. Institute for Global Environmental Strategies (IGES). Retrieved from https://www.ipcc.ch/site/assets/uploads/2018/03/GPG_LULUCF_FULLEN.pdf

Description	Defaults	Units	Source
Average total tree live biomass, kg oven dry matter (kg)	12.1695	kg	Schepaschenko D. et al (2017)[190] Average of trees with average total tree live biomass, kg oven dry matter (kg) in region of Kazakh forest steppe, Kazakh steppe and Kazakh upland.
Average Carbon fraction of biomass for tree vegetation	0.5	(Tonnes d.m)$^{-1}$	From page 3.146 Chapter 3: LUCF Sector Good Practice Guidance[191]
Conversion factor: ratio of molecular weights of CO_2 and C	$\frac{44}{12}$	Mol mol^{-1}	UNFCCC[192]

Table 6-110: activity data – number of trees cleared

Type	Value	Units	Source	Tier
Trees	12541	number	Flora Inventory Report	3

6.7.5.2 FUGITIVE EMISSIONS – METHANE GAS VENTING

As the railway will intersect main gas pipelines owned by AGP LLP, existing natural gas pipeline will be shut off for 30 days during construction before being reinstalled/reconnected with upgraded sections of the gas pipeline. The gas built up in the existing main pipelines will need to be vented. Methane gas will make up 97% of the gas according to the operational design document. Since methane gas is a greenhouse gas, the estimated emissions were calculated by multiplying the volume of gas vented with the GWP of methane, according to **Equation 6-1**. From **Table 6-111**, the total amount of methane that will be vented is 9,427.35 tonnes/year, multiplied by methane (CH_4) GWP of 29.8 tCO_{2-e}/t CH_4 which is equivalent to 280, 935 tCO_{2-e} for the entire construction period.

TABLE 6-111: ACTIVITY DATA – VOLUME OF METHANE VENTED AT QUARRY OF ZHANA ARNA STATION

Description		Defaults	Units	Source	Tier
Methane gas vented at section no 1	Line "A"	1403.33	tonnes	EIA	3
	Line "B"	1403.33	tonnes	EIA	3
	Line "C"	2215.612	tonnes	EIA	3
	Line "A"	1396.735	tonnes	EIA	3

[190] Schepaschenko, D., Shvidenko, A., Usoltsev, V. A., Lakyda, P., Luo, Y., Vasylyshyn, R., Lakyda, I., Myklush, Y., See, L., McCallum, I., Fritz, S., Kraxner, F., & Obersteiner, M. (2017). *Biomass tree database [dataset].* PANGAEA. https://doi.org/10.1594/PANGAEA.871491, In supplement to: Schepaschenko, D., et al. (2017). A dataset of forest biomass structure for Eurasia. *Scientific Data, 4*, 170070. https://doi.org/10.1038/sdata.2017.70
[191] Intergovernmental Panel on Climate Change (2003). Good Practice Guidance for Land Use, Land-Use Change and Forestry. In IPCC National Greenhouse Gas Inventories Programme. Institute for Global Environmental Strategies (IGES).
[192] UNFCCC/CCNUCC & CDM Executive Board. (2009). *Estimation of GHG emissions due to clearing, burning, and decay of existing vegetation attributable to a CDM A/R project activity* (Report, p. 4). Retrieved from https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-08-v3.pdf

Description		Defaults	Units	Source	Tier
Methane gas vented at section no 2	Line "B"	1396.735	tonnes	EIA	3
	Line "C"	1611.61	tonnes	EIA	3
Total volume of methane gas	9,427.35 tonnes/year				

6.7.5.3 MOBILE COMBUSTION – DIESEL OIL (DO)

GHG emissions from on-road transportation and off-road construction and mobile combustion in the construction phase are calculated based on **Equation 6-6**[193]. It is noted that only Diesel Oil (DO) will be used for vehicles during the construction phase which is anticipated to last for approximately two (2) years. The activity data for mobile combustion is taken in the form of $Q \times EC$ as in **Equation 6-3**. The defaults for EC and EF are presented in

Table 6-112, and the defaults for GWP are in **Table 6-109**. The equations for off-road and on-road combustion are provided in the following section.

EQUATION 6-3: MOBILE COMBUSTION

$$E = \frac{(Q \times EC) \times EF \times GWP}{1000}$$

Where:

E	= Estimated emissions of gas from fuel type	(t CO_2e)
Q	= Estimated quantity of fuel type	(unit)
EC	= Energy content factor of fuel	(GJ per unit)
EF	= EF for each fuel type	(kg CO_2e per gigajoule - GJ)

TABLE 6-112: EF AND OTHER DEFAULTS – MOBILE COMBUSTION

Description	Mobile Combustion		Units	Source	Tier
	On-road	Off-road			
EC - Net calorific value for DO	42.6		GJ/tonne	National EIA	3
DO density	0.85		tonne/m^3	National EIA	3
CO_2 EF – DO	74.1	74.1	kg CO_2-e/GJ	IPCC (2021)	1
CH_4 EF – DO	0.116	0.124	kg CO_2-e/GJ	IPCC (2021)	1
N_2O EF – DO	1.065	7.808	kg CO_2-e/GJ	IPCC (2021)	1

Off-road combustion

Based on the list of construction machines that are expected to be involved in a construction shift (see **Appendix C**), the DO consumption rate of each machine, the total number of each piece of equipment used and the total number of working days in a year in Kazakhstan (249 working days based on a 5-day work week), we calculated the total amount of DO consumed

[193] NGER (2017). Technical Guidelines for the estimation of emissions by facilities in Australia, National Greenhouse and Energy Reporting Scheme Measurement.

in a year. The calculation for fuel consumption by type of vehicle is derived from information provided by KTZ.

EQUATION 6-4: OFF-ROAD FUEL CONSUMPTION

$$Q_{off-road} = \sum_{i,j} \left[Vehicles_{i,j} \times Consumption_{i,j}\right] \times Shifts \times Work\ days$$

Where:

$Q_{off-road}$	= Estimated quantity of fuel consumed for off-road	(litres/year)
$Vehicles_{i,j}$	= Number of vehicles of type i and those using fuel j	
$Consumption_{i,j}$	= Fuel consumption by type i vehicles and those using fuel j	(litres/hour)
$Shift$	= Total number of hours in one shift	
$Work\ days$	= Total number of working days in year	
i	= Vehicle type (e.g. loader, truck crane)	
j	= Fuel type (e.g. DO)	

On-road combustion

Based on the information provided from KTZ, there is one type of on-road vehicle used during the construction phase: Crew Bus. It will clock 100km of distance per day, with an estimated fuel consumption of 3,600 litres per day based on the information provided. However, it was assessed that, based on a common understanding of buses in general, the figure provided is too large. Hence, ERM has made a few assumptions and used proxies for the calculation. There are currently no national or international standards that specify fuel consumption in litres per kilometre travelled by a vehicle. The fuel consumption is an assumption based on data for 12-meter buses by country[194]. We took an average of the diesel consumption from the regions listed in the study to derive an international figure of 40.1 litres per 100km.

Given that there are 249 working days in a year, the quantity of DO used (litres/year) can be calculated using **Equation 6-5**. The activity data of the Project for off-road and on-road combustion are presented in

Table 6-113.

EQUATION 6-5: ON-ROAD FUEL CONSUMPTION

$$Q_{on-road} = \sum \left[Distance_{i,j} \times Shifts \times Work\ days\right] \div Consumption_{i,j}$$

Where:

$Q_{on-road}$	= Estimated quantity of fuel consumed for on-road	(litres/year)
$Distance_{i,j}$	= Total kilometres travelled in a day per vehicle type i and using fuel j	(km/day)
$Consumption_{i,j}$	= Fuel consumption by type i vehicles and those using fuel j	(km/L)

[194] Li, X., Gao, J., & Song, S. (2020). *The costs and benefits appraisal tool for transit buses.* WRI Publications. https://doi.org/10.46830/writn.19.00147

$Shift$	= Total number of hours in one shift
$Work\ days$	= Total number of working days in year
i	= Vehicle type (e.g. bus)
j	= Fuel type (e.g. DO)

TABLE 6-113: ACTIVITY DATA – MOBILE COMBUSTION (DIESEL OIL)

Type	Value	Units	Source	Tier
On-road	2,553	GJ	IRL	3
Off-road	58,436			

6.7.5.4 STATIONARY COMBUSTION – LIQUIFIED PETROLEUM GAS (LPG)

For this project, LPG will be used in winter during construction phase for heating purpose for the boiler room and rotational camp's bath.

EQUATION 6-6: EMISSIONS CALCULATION BASED ON FUEL CONSUMPTION

$$Emissions = Fuel\ Consumption \times Emissions\ Factor$$

In which:

- Emissions relates to emissions of a given GHG by type of fuel (kg GHG)
- Fuel consumption = amount of fuel combusted (m^3)
- Emission Factors (EF) relates to default emission factor of a given GHG by type of fuel (kg gas/TJ). For CO_2, it includes the oxidation factor, assumed to be 1.

The activity data, EFs and other defaults used in **Equation 6-6** are presented in **Table 6-114**. The results of the calculations are shown in **Table 6-119** and the list of emissions sources included in the calculations can be found in **Appendix C**.

TABLE 6-114: ACTIVITY DATA, EF AND OTHER DEFAULTS – STATIONARY COMBUSTION (LPG)

Description	Value	Units	Source	Tier
Activity data – LPG used during winter (Construction)	1,302,750	m^3	National EIA	3
Low heating value for LPG	46.3	GJ/tonne	National EIA	3
LPG density (Normal Condition in Winter)	0.001963	tonne/m^3	National EIA	3
CO_2 EF – LPG ($EFCO_2$,ox,ec)	63.1	kg CO_2-e/GJ	IPCC	1
CH_4 EF – LPG	0.03	kg CO_2-e/GJ	IPCC	1
N_2O EF – LPG	0.027	kg CO_2-e/GJ	IPCC	1

6.7.5.5 STATIONARY COMBUSTION – DIESEL OIL (DO)

For this project, diesel oil will be used all year during the construction phase for sources in equipment such as the air compressor, bitumen boiler, wielding unit, mobile diesel power plant and diesel generator.

The activity data, CO_2 EF and other defaults used in **Equation 6-6** are presented in **Table 6-115**. The results of the calculations are shown in **Table 6-119** and the list of emissions sources included in the calculations can be found in **Appendix C**.

TABLE 6-115: ACTIVITY DATA, EF AND OTHER DEFAULTS – STATIONARY COMBUSTION (DIESEL)

Description	Value	Units	Source	Tier
Activity data –DO used	1,839.49	tonnes	National EIA	3
Net calorific value for DO	42.6	GJ/tonne	National EIA	3
DO density	0.85	tonne/m^3	National EIA	3
CO_2 EF – Diesel ($EFCO_2$,ox,ec)	74.1	kg CO_2-e/GJ	IPCC	1
CH_4 EF – Diesel	0.089	kg CO_2-e/GJ	IPCC	1
N_2O EF – Diesel	0.164	kg CO_2-e/GJ	IPCC	1

6.7.6 ASSESSMENT METHODOLOGY - OPERATIONAL PHASE

6.7.6.1 STATIONARY COMBUSTION – LPG

During the operational phase, LPG will be used during summer and winter for the boiler rooms at Zhana Arna Station, Kazybek Bek Station and Zhetygen Station.

The activity data, EFs and other defaults used in **Equation 6-6** are presented in **Table 6-116**. The results of the calculations are shown in **Table 6-119** and the list of emissions sources included in the calculations can be found in **Appendix C**.

TABLE 6-116: ACTIVITY DATA, EF AND OTHER DEFAULTS – STATIONARY COMBUSTION (LPG)

Description	Value	Units	Source	Tier
Activity data – LPG used during winter (Operations)	1,523,054.00	tonne/m^3	National EIA	3
Activity data – LPG used during summer (Operations)	1,083,817.40	tonne/m^3	National EIA	3
Low heating value for LPG	46.3	GJ/tonnes	National EIA	3
LPG density (Normal Condition in Winter)	0.001963	tonne/m^3	National EIA	3
LPG density (Normal Condition in Summer)	0.002074	tonne/m^3	National EIA	3

6.7.6.2 STATIONARY COMBUSTION – DO

For this project, diesel oil will be used all year during the operational phase for sources in equipment such as the boiler room, manoeuvring a diesel locomotive and diesel generator.

The activity data, CO_2 EF and other defaults used in **Equation 6-6** are presented in **Table 6-117**. The results of the calculations are shown in **Table 6-119** and the list of emissions sources included in the calculations can be found in **Appendix C**.

TABLE 6-117: ACTIVITY DATA, EF AND OTHER DEFAULTS – STATIONARY COMBUSTION (DO)

Description	Value	Units	Source	Tier
Activity data – DO used (Operations)	299.11	tonnes	National EIA	3
Net calorific value for DO	42.6	GJ/tonne	National EIA	3
DO density	0.85	tonne/m^3	National EIA	3
CO_2 EF – Diesel ($EFCO_2$,ox,ec)	74.1	kg CO_2-e/GJ	IPCC	1
CH_4 EF – Diesel	0.089	kg CO_2-e/GJ	IPCC	1
N_2O EF – Diesel	0.164	kg CO_2-e/GJ	IPCC	1

6.7.6.3 PURCHASED ELECTRICITY

According to the data provided, the power demand for the Project based on future sizes of transportation during the operational phase is estimated to be about 85,600,000 kWh (85,600 MWh). It is assumed that the project has an operational lifetime of 30 years and it is assumed that electricity is consumed all year round with no shutdown or scheduled maintenance.

The EF for electricity from Kazakhstan's grid in the year 2021 is 0.532 tCO2/MWh (IFI, 2022). Since there is no locomotive-specific activity data available, the above assumptions were taken to estimate emissions.

The activity data and EF for calculating GHG emissions regarding purchased electricity are presented in **Table 6-118**.

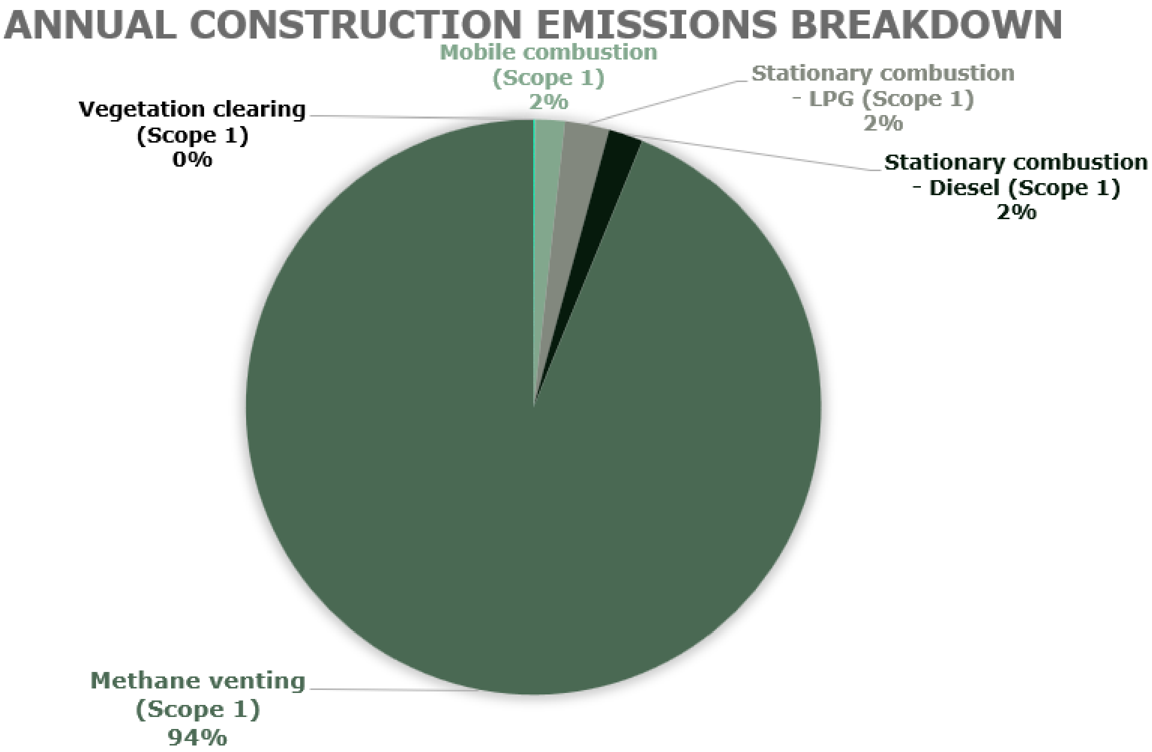
TABLE 6-118: ACTIVITY DATA AND EF – PURCHASED ELECTRICITY

Description	Value	Units	Source	Tier
Activity data – Electricity demand	85,600	MWh/year	National EIA	3
CO_2 EF – Electricity	0.532	tCO_2/MWh	IFI (2022)	1
CH_4 EF – Electricity	N/A			
N_2O EF – Electricity	N/A			

6.7.7 CARBON FOOTPRINT ACCOUNTING RESULTS

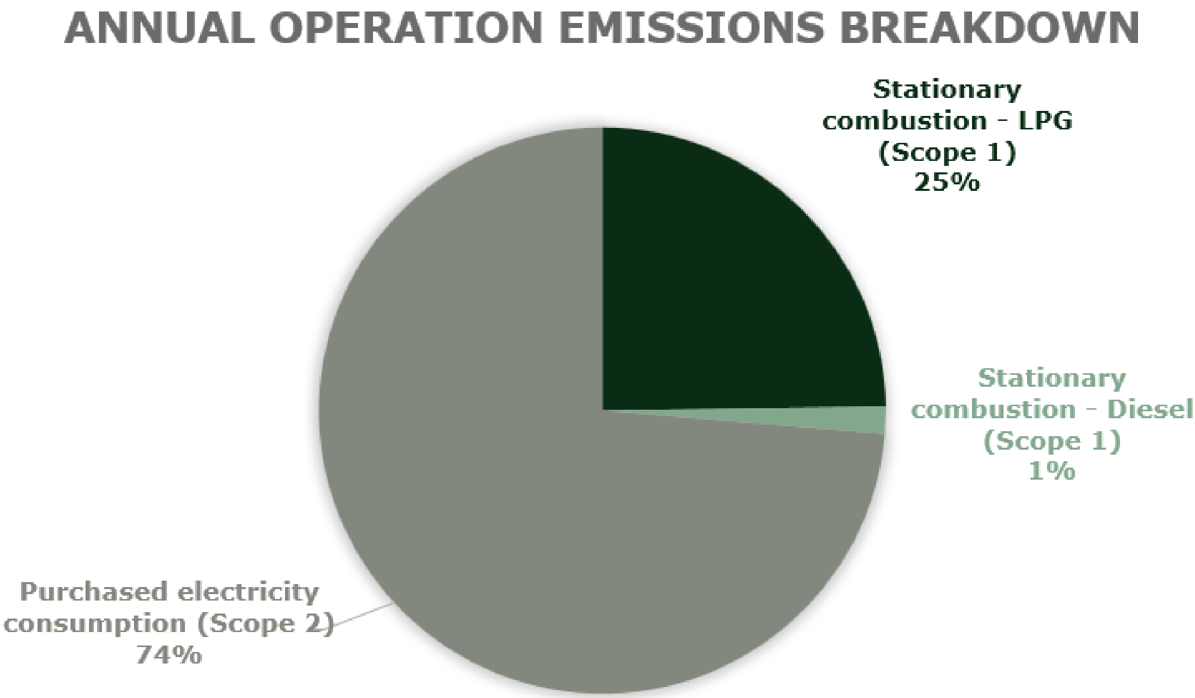
The construction phase is expected to last for two years. For the construction phase, the annual emissions are estimated to be 299,495 tCO_2e/year (**Table 6-119**). Methane gas venting – scope 1 accounts for the largest share of emissions in the first year (94%) as seen in **Figure 6-41.**

FIGURE 6-41: ANNUAL CONSTRUCTION EMISSIONS BREAKDOWN



The operational phase is planned to last for 30 years. In this phase, the electricity consumed (scope 2), mainly by trains, is anticipated to result in 45,539 tCO_2e/year (**Table 6-119**), accounting for 74% of the annual emissions during the operation phase (**Figure 6-42)**. Annual emissions of stationary combustion of LPG will account for 15,316 t CO_2e/year which is 25% of the total annual emissions during operation.

FIGURE 6-42: ANNUAL OPERATION EMISSIONS BREAKDOWN



As indicated in **Table 6-119**, the Project is estimated to emit roughly 2,171,850t CO_2e throughout its lifespan, in which the carbon footprint of the operation phase is the most significant (85.37%).

TABLE 6-119: ESTIMATED CARBON FOOTPRINT FOR THE PROJECT

Phase	Description	Annual Greenhouse Gas Emissions			Total Annual Greenhouse Emissions	
		CO_2	CH_4	N_2O	tCO_2e	Percentage (%)
Construction (Year 1)	Vegetation Clearance	280	0	0	280	0%
	Methane Gas venting	0	280,935	0	280,935	94
Construction (Year 1-2)	Mobile combustion – DO- Scope 1	4,519	8	459	4,986	2%
	Stationary Combustion – LPG - Scope 1	7,472	4	3	7,479	2%
	Stationary Combustion – DO - Scope 1	5,807	7	2	5,816	2%
	Total annual	**18,078**	**280,953**	**464**	**299,495**	**100%**
	Total for phase	**35,876**	**280,971**	**929**	**317,776**	**14.63%**
Operation (Year 3-32)	Stationary Combustion – LPG - Scope 1	15,302	7	7	15,316	25%
	Stationary Combustion – DO - Scope 1	944	1	2	947	2%
	Electricity	45,539	0	0	45,539	74%
	Total annual	**61,785**	**8**	**9**	**61,802**	**100.0%**
	Total for phase	**1,853,562**	**251**	**261**	**1,854,075**	**85.37%**

6.7.8 RELATIVE EMISSIONS ASSESSMENT

A high-level Relative Emissions Assessment has been conducted to assess the total avoided emissions from constructing the bypass. The total avoided emissions refers to the difference between baseline emissions, i.e., emissions before the project, and project emissions, i.e., emissions after the project.

Total avoided emissions for the project are estimated to be 75,960 tCO_2e per year. This is a high-level estimation based off data in the Operational Design document (Poligram, 2023). Due to constraints such as a lack of data, we had to make multiple assumptions which are outlined below.

6.7.8.1 ASSUMPTIONS FOR GHG SAVING CALCULATIONS

1. **Modal shift:** The Bypass will mainly transport freight. Thus, modal shift for passengers have not been considered.

- **Emission factor (EF):** For Heavy Goods Vehicle (HGV), 0.09696 kgCO_2e per tonne.km for average laden all diesel HGV and for rail, 0.02779 kgCO_2e per tonne.km taken from UK Government Department for Energy Security and Net Zero Greenhouse Gas Conversion Factors 2023[195].

2. **Freight train traffic in 2022:** This value includes all trains, laden and empty, from Zhetygen to Kazybek Bek and back.

- **Predicted freight train traffic:** Freight train traffic was predicted for 2025 to 2040. We have used 2030 data as a proxy.

3. **Projected volume of traffic:** We took an average of total projected volume of traffic for the Zhetygen – Kazybek Bek – Zhetygen section from 2025 to 2040 as outlined in the Operational Design document.

- **Historical volume of traffic:** This value was calculated by dividing the projected volume of traffic by the increase in freight train traffic after the project.

4. **Freight distance travelled:** This value is the average of operating length across Almaty-1 -Otar - Shu, Almaty-1 - Zhetygen, Zhetygen - Sary - Ozek, Zhetygen – Altynkol, from the Operational Design document.

- **Total new rail freight:** This value has been calculated using freight distance travelled multiplied by projected volume of traffic minus freight distance travelled multiplied by historical volume of traffic.

TABLE 6-120: ACTIVITY DATA AND EF – GREENHOUSE GAS SAVINGS

Description	Value	Units	Source
Freight train traffic in 2022	32	trains/day	Operational design document [a]
Predicted freight train traffic in 2030	50	trains/day	Operational design document [a]
Increase in freight train traffic after project	56	%	Calculated
Historical volume of traffic	9,866,667	tonnes/year	Calculated
Projected volume of traffic	15,392,000	tonnes/year	Operational design document [a]
Freight distance travelled	198.75	km	Operational design document [a]
Total new rail freight (t.km)	1,098,160,018	t.km	Calculated

[195] UK Government Department for Energy Security and Net Zero (2023). *Greenhouse Gas Conversion Factors 2023: condensed set.* Retrieved from: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2023

Description	Value	Units	Source
All diesel, average laden Heavy Goods Vehicle (HGV) EF	0.09696	$kgCO_2e$/tonne.km	UK Government Department for Energy Security and Net Zero Greenhouse Gas Conversion Factors 2023
Rail EF	0.02779	$kgCO_2e$/tonne.km	
Emissions if freight had gone on road (baseline emissions)	106,478	tCO_2e/year	Calculated
Emissions of freight on rail (project emissions)	30,518	tCO_2e/year	Calculated
Avoided emissions	75,960	tCO_2e/year	Calculated
Note: [a] Poligram, 2023			

6.7.9 MITIGATION MEASURES

Based on the outcome of the GHG emissions assessment, a set of recommended management and monitoring measures are proposed in **Table 6-121** to manage the estimated GHG intensity of the Project. The mitigation measures are applicable to the operations phase as the project construction is already underway.

Given that the largest source of emissions comes from electricity consumption, a key consideration is the decarbonization of the electricity grid through the transition to renewable sources. This shift can significantly reduce overall emissions during the operation phase. However, it is important to note that transitioning to renewable sources lies beyond the project's direct control. For stationary emissions, a key decarbonisation lever is to electrify equipment and reduce reliance on DO or LPG. Combustion of DO and LPG tend to emit higher levels of carbon, nitrogen oxides (NOx) and other pollutants than electricity.

Making the switch to energy efficient products can also help to decrease emissions by consuming less power for the same level of performance.

TABLE 6-121: RECOMMENDED MITIGATION MEASURES (OPERATION PHASE)

Category	Mitigation and Management Measures
Locomotive	• Implement training programs to educate employees to adopt techniques that eliminate unnecessary idling thus reducing fuel and energy consumption. Typically, the policies and programs impose time limits on how long a locomotive can idle when the main engine is not required (InTech, 2023). • The implementation of anti-idling engine management software helps to balance energy demand and fuel consumption. Similar technologies, such as automatic engine stop-start (AESS) systems, which shut down the engine after idling for more than 10 minutes.
Fuel management	• Procure renewable electricity to decrease the emissions intensity of power supplied from the grid, which is currently very high. • Onsite renewables (e.g. solar PV on station roofs) may also be an option to help power stationary assets such as station lights, maintenance facilities, etc.

Category	Mitigation and Management Measures
	• Conduct regular maintenance of equipment (boilers, generators etc.) to ensure they are running on optimal conditions and do not consume more fuel than necessary.
Energy efficiency	• Use energy meters to monitor energy consumption. • Use of energy efficient lighting at stations, site offices and accommodations to reduce Scope 2 emissions. • Use of energy efficient air conditioners. • Optimising cable sizes and joints to control voltage drops. • Use of proper size and length of cables and wires to match equipment rating.
Fugitive emissions	• Maintain equipment such as air-conditioners, fire-extinguishers and refrigerator appropriately to minimise the risk of unintended leaks and unnecessary venting. • Consider procuring equipment that uses low- or no-GWP refrigerant gases, e.g. ammonia or CO_2-based systems.

6.7.10 DATA IMPROVEMENT PLAN

Scope 1 and 2 emissions for the Project were estimated and based on conservative assumptions based on the information provided by KTZ. The results from the GHG assessment in this report may not reflect the true quantity of emissions of the Project, as some GHG sources that might be significant are screened out due to the lack of information at the time writing this report.

We recommend updating the GHG inventory with complete data to reflect the true GHG intensity of the Project. Closing the data gaps noted in **Table 6-122** would allow for a more representative understanding of GHG emissions. The data gaps should be prioritised in order of their materiality.

TABLE 6-122: DATA IMPROVEMENT SUGGESTIONS

Emissions Source	Construction	Operations
Vegetation Clearing	Emissions from this source is not material and hence no further data required.	No vegetation clearance is necessary during the operations phase and hence no further data is required.
See Mobile Combustion – Fuel (on- and off-road)	**Request for missing fuel consumption data for construction equipment.**	**Request for fuel consumption information for operational mobile combustion sources.** No information about amount of fuel and type of fuel was provided for mobile combustion during operational phase.
Stationary Consumption – Liquified Petroleum Gas (LPG)	Most information provided, no further information required.	Most information provided, no further information required.

Emissions Source	Construction	Operations
Stationary Consumption – Diesel	Most information provided, no further information required.	Most information provided, no further information required.
Purchased Electricity	No electricity will be used during the construction stage hence no further data is required.	Most information provided, no further information required.
Air-conditioning / refrigeration	No information is available at this stage on the types of such systems. Considering the high GWP of refrigerants, further data should be requested.	No information is available at this stage on the types of such systems. Considering the high GWP of refrigerants and longer period of use, further data should be requested.
On-site solid waste treatment	N/A	N/A
On-site wastewater treatment	N/A	Request more information for on-site wastewater treatment systems.
Fugitive SF_6 used in switchgears	N/A	Request for SF_6 capacity used in switchgear and the estimated refills
Fugitive CO_2 from extinguisher systems	It is not clear whether chemical fire extinguishers will be used. Considering the high GWP of refrigerants, further data should be requested.	It is not clear whether chemical fire extinguishers will be used. Considering the high GWP of refrigerants, further data should be requested.

Note**:** White-filled cells mean no further data is required. Yellow-filled cells indicate a low-priority data gap to close. Orange-filled cells represent a medium-priority data gap to close. Red-filled cells indicates a top-priority data gap to close.

6.7.11 CONCLUSION

The following conclusions arise from the GHG Assessment:

- Scope 1 and Scope 2 emissions for the Project were estimated based on conservative assumptions made relying upon the information provided by KTZ. The results from the GHG assessment in this report may not reflect the true quantity of emissions of the Project, as some GHG sources that might be significant, are screened out due to the lack of information at the time writing this report. Obtaining further data as stated in **Table 6-122** is recommended to reflect the true GHG intensity of the Project.
- Annual Scope 1 and Scope 2 GHG emissions in the construction phase are estimated to be 299,495 tCO_2e/year. This phase is anticipated to last for two years, resulting in total GHG emissions of 317,776 tCO_2e.
- The operational phase is expected to last for 30 years. Annual GHG emissions are estimated to be 61,802 tCO_2e/year under normal operating conditions. The total GHG emissions for the entire operation phase are anticipated to be 1,854,075 tCO_2e.
- The key opportunity to decarbonise the project is to procure renewable electricity from the grid to power trains that run on the Project railway. This could be done through a power purchase agreement with a large offsite renewable energy project (e.g. a wind and/or solar farm), building rooftop solar onsite or by advocating for policies that help transition Kazakhstan's grid from its current high dependence on fossil fuel generation sources to renewable sources.

- In accordance with the requirements of IFC, the Project should conduct a comprehensive GHG emission estimation each year of operation with updated actual data. Emission estimates should be derived referencing internationally recognised emission measurement methodologies. The GHG report must be reported publicly as per the disclosure requirement.
- The GHG management plan should be prepared in a way that correctly and diligently implements both existing controls, management, and monitoring measures presented in this GHG assessment.

6.8 TRANSITION CLIMATE CHANGE RISK ASSESSMENT

In accordance with the requirements of the IFC and EP4, certain Climate Risk Assessments (CRA) and related studies are obligatory for certain category of projects. For all Category A projects, and as appropriate, category B projects, a CRA of Physical Risks is required. In addition, for those projects with greenhouse gas (GHG) emissions (in Scopes 1 and 2) exceeding 100,000 tonnes of CO_2 equivalent annually, an Alternative Analysis and a CRA of Transition Risks must be undertaken. As the GHG emissions from the current railroad project is expected to be lower than 100,000 tonnes of CO_2 equivalent, a Transition Risks CRA was not performed. Instead, the focus has been on the Physical Risks CRA, which is presented in the following section. However, there was a need to assess the project's alignment with the host country's Nationally Determined Contributions (NDCs) under the Paris Agreement, and this evaluation is covered in the subsequent section.

6.8.1 PARIS AGREEMENT AND KAZAKHSTAN'S NATIONALLY DETERMINED CONTRIBUTIONS

Kazakhstan submitted its updated First NDC in 2023, which includes an unconditional target of reducing emissions by 15% by 2030 and a conditional emissions reduction target of 25% relative to the 1990 baseline. The NDC covers energy, industrial processes and product use, agriculture, forestry and other land use, and waste sectors. Kazakhstan aims to achieve carbon neutrality by 2060[196].

The revised NDC includes adaptation components for the first time, with a focus on agriculture, water, forestry, and disaster risk management. The country plans to expand adaptation measures to other sectors affected by climate change impacts such as health and infrastructure.

It published its strategy for achieving the carbon neutrality by 2060[197] in 2023.

6.8.1.1 STRATEGY OF THE REPUBLIC OF KAZAKHSTAN ON ACHIEVING CARBON NEUTRALITY BY 2060

Introduction

The strategy document outlines the country's roadmap to achieve carbon neutrality by 2060. It responds to global climate trends and international commitments, aiming to adapt the economy to challenges like the Carbon Border Adjustment Mechanism (CBAM), promote green investments, and foster energy-efficient manufacturing.

Current situation in Kazakhstan

Kazakhstan has experienced the adverse impacts of climate change, including rising temperatures and decreasing precipitation. The country's economic recovery in the early 2000s resulted in a rise in GHG emissions, which peaked in 2018. However, emissions declined in

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[196] Government of Kazakhstan. (2023). *Updated nationally determined contributions (NDCs)*. United Nations Framework Convention on Climate Change (UNFCCC). Retrieved from https://unfccc.int/sites/default/files/NDC/2023-06/12updated%20NDC%20KAZ_Gov%20Decree313_19042023_en_cover%20page.pdf

[197] Government of Kazakhstan. (2024). *Kazakhstan strategy for carbon neutrality by 2060*. United Nations Framework Convention on Climate Change (UNFCCC). Retrieved from https://unfccc.int/sites/default/files/resource/Carbon_Neutrlaity_Strategy_Kazakhstan_Eng_Oct2024.pdf

2019 and 2020 due to reduced fuel consumption and the impact of the COVID-19 pandemic. Emissions beyond 2020 have not been assessed yet.

The energy sector is the largest contributor to GHG emissions in Kazakhstan, responsible for 77.6% of national net emissions in 2020. The country's abundant fossil fuel reserves, particularly coal, have resulted in a carbon-intensive energy system. Other significant emitting sectors include agriculture, industrial processes, and waste.

Basic Framework

The Strategy aims to make Kazakhstan's economy resilient to climate change and achieve carbon neutrality by 2060. The mid-term target is to reduce GHG emissions by 15% by 2030, with a conditional goal of 25% reduction subject to international support.

The Strategy is guided by principles such as technical and economic feasibility, just transition, circular economy, and transparency. It emphasizes attracting investments, modernizing industries, and utilising digital technologies for monitoring and control.

Sectoral and Cross-Cutting Approaches

The Strategy outlines sector-specific approaches for decarbonisation:

- Energy: Transition to renewable energy sources, improve energy efficiency, and electrify energy consumption.
- Industry: Adopt alternative materials, increase waste recycling, and implement low-carbon manufacturing technologies.
- Agriculture and Forestry: Promote sustainable farming practices, improve irrigation, and expand afforestation and reforestation efforts
- Waste Management: Reduce waste generation, improve waste collection and sorting, and increase recycling and composting.

Cross-cutting approaches include:

- Just Transition: Support workers in transitioning to green jobs and ensure social protection.
- Financing and Green Investments: Attract private and international investments for green projects and develop a carbon fund.
- Research and Development: Promote research in low-carbon technologies and education in climate-related fields.
- Behavioural Change: Raise public awareness about climate change and encourage sustainable consumption patterns.
- International Cooperation: Collaborate with international organisations and partners to access technology, finance, and expertise.
- Climate Change Adaptation: Integrate climate adaptation measures into planning and development processes.
- Carbon Regulation: Establish a carbon regulation system, including emissions trading, carbon taxation, and a unified digital ecosystem.

Transport sector focus

The energy sector reporting covers fuel combustion in Transport which includes all types of transport operations (except for military transport). Fuel emissions from any air or maritime transport involved in international operations is considered separately. Currently in Kazakhstan, the transport sector accounts for 6.6% of value added and roughly 6.9% of employment in the economy. Economic development over the past decades has vitalized the transport sector too and led to increased number of vehicles and related GHG emissions. In the past 15 years, car ownership by households and businesses, as well as passenger traffic in automobile transport has tripled. The transport sector is operating almost exclusively on fossil fuels and is one of the main sources of GHG emissions.

Also, most automobile transport in Kazakhstan are private cars. This is reflected in the mix of GHG emissions from this sector. A large proportion of road transport GHG emissions from fuel combustion reflects a relatively high motorisation rate in the country, while the car fleet largely consists of old and outdated vehicles.

The country has a vision to move away from fossil fuel dependence of the transport sector to electric power, hydrogen and biofuels-based system by 2060.

It wants to align the transport sector with the concept of “Avoid-Shift-Improve” to achieve the low carbon transport sector:

- avoided or reduced need for travel (Avoid);
- shift to more environmentally friendly modes of transport (Shift);
- higher efficiency in energy use and reduction of emissions from vehicles (Improve).

The first point ‘Avoid’ is defined as falling demand for energy by passenger cars, efficient management of passenger and freight traffic, development of public transport system, and efficient urban planning to reduce the need in vehicle trips.

Urban planning and transport infrastructure will be improved to achieve decarbonisation in the transport sector. Sustainable urban mobility and public transport will be promoted through optimisation of passenger operations, extensive electrification and gasification.

Conclusion

Considering the role of public transport envisaged in the Strategy document by the Republic of Kazakhstan in reducing emissions from use of energy in the transport sector, we see that this railroad project will help Kazakhstan achieve its Paris-aligned targets on GHG reduction as it will help reduce emissions form the transport sector. Hence, see this project as aligned with the country’s NDCs to support Paris alignment.

6.9 PHYSICAL CLIMATE CHANGE RISK ASSESSMENT

Physical climate risks are defined as risks arising from the physical effects of climate change, which can be event-driven (acute) or associated with longer-term shifts in climate patterns (chronic). It may have financial implications for organisations, such as direct damage to assets and indirect impacts from supply chain disruption.

A materiality-based approach that aligns with the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) was used to evaluate the potential physical impacts of climate change. The main objectives are to:

- Identify physical hazards to which the Site is exposed during the Baseline as well as in future time horizons under the considered scenarios.

- Understand the likely implications of these natural climate hazards on the Project in forward-looking climate scenarios.

The proposed study aims to provide a high-level evaluation of physical risks that may be relevant to the Project facilities in Kazakhstan. ERM will assess the impact of climate change on the following hazards/variables:

- Extreme Heat
- Extreme Cold
- Riverine Flood
- Extreme Rainfall Flood
- Coastal Flood
- Water Scarcity
- Cyclones
- Landslides
- Wildfires

This physical Climate Change Risk Assessment (CCRA) is a desk-based study comprising of a literature review and analysis of readily available open and paid data sources. To generate climate indicators, ERM uses the latest multi-ensemble suite of climate models from the Coupled Model Intercomparison Project, Phase 6 (CMIP6) database, which is compatible with the Intergovernmental Panel for Climate Change Sixth Assessment Report (IPCC-AR6). Accordingly, ERM uses the latest Shared Socioeconomic Pathways (SSPs) emission scenarios for future projections.

From the CMIP6 suite of climate scenarios, ERM proposes using the following two scenarios to cover a full range of potential paths and projections.

- **SSP1-2.6:** Sustainable Path - Reaching net-zero after 2050, global mean temperatures stabilising around 1.8°C by 2100.
- **SSP5-8.5:** Worst Case - CO_2 emissions double by 2050 with the mean global temperature reaching above 4.4°C by 2100.

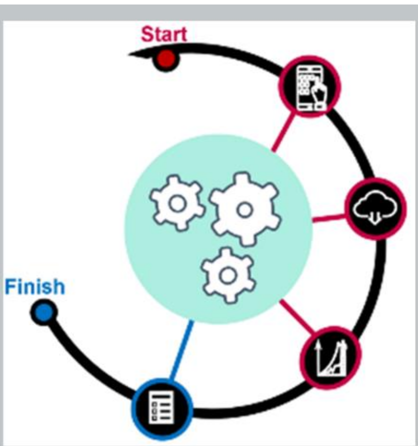
ERM will evaluate the effect of climate change on the identified natural hazards for the baseline and future time horizons (i.e., the 2030s and 2050s) under the considered scenarios.

6.9.1 PHYSICAL RISK ASSESSMENT METHODOLOGY

ERM's Climate Impact Platform (CIP) provides a framework and leading data to conduct physical risk assessments across different sectors and geographies. This physical CCRA is conducted through four key steps as outlined in **Figure 6-43**.

- **Steps 1-3 (in red)** involve the high-level screening of the Project through the collection and analysis of climate data and climate trends.
- **Step 4 (in blue)** constitutes the review of hazards that are identified as posing potential material risks to the Project.

FIGURE 6-43: SUMMARY OF THE FOUR KEY STEPS OF PHYSICAL CCRA



Step 1 - (Screening): High-level screening of Assets against the range of Physical Climate Hazards that are potentially material risk.

Step 2 - (Climate Data Collection): Gather Climate data for all relevant Physical Hazards for the baseline and future time horizons for the considered scenarios using our in-house Global Climate Database (GCD), which is supplemented by climate data from the best available online data sources [i.e., IPCC, WRI, International Best Track Archive for Climate Stewardship (IBTrACS), Fathom, NASA, European Space Agency, and The World Bank] and data provided by the client.

Step 3 - (Climate Data and Trend Analysis): Analyze the Climate data for the baseline period to identify the presence of any hazards that are relevant to the project. Then using the latest available modelled data, explore how each relevant physical hazard is projected to change in the future.

Step 4 - (Risk Review): Trends in the climate data are then assessed along with the relevant information provided by the client about assets to review the presence of potential materiality of Climate risk.

6.9.1.1 STEP 1-SCREENING

For the physical CCRA, the high-level screening of the following hazards has been conducted in **Table 6-123**.

TABLE 6-123: CLIMATE NATURAL HAZARDS ASSESSED FOR THE PHYSICAL RISKS

No.	Climate Hazard	Risk Category	Indicator	Description
1	Extreme Heat	Acute / Chronic	Warm Spell Duration Index (days)	The annual number of days contributing to unusually warm events where 6 or more consecutive days experience a maximum temperature of greater than the 90^{th} percentile of the historical averages for that time of year.
2	Extreme Cold	Acute	Cold Spell Duration Index (days)	The annual number of days contributing to unusually cold events where 6 or more consecutive days experience a minimum temperature of less than the 10^{th} percentile of the historical averages for that time of year.
3	Riverine Flooding	Acute	1-in-500-year River Flooding Inundation Depth (meters)	The maximum inundation depth experienced within a 270m x 270m area that is associated with a 1-in-500-year undefended river flooding event.
4	Extreme Rain Flooding	Acute	1-in-500-year Rainfall Flooding Inundation Depth (meters)	The maximum inundation depth experienced within a 270m x 270m area that is associated with a 1-in-500-year pluvial (extreme-rainfall-induced) flooding event.
5	Coastal Flooding	Acute / Chronic	1-in-500-year Coastal Flooding Inundation Depth (meters)	The maximum inundation depth associated with a 1-in-500-year coastal flooding event as a result of projected sea level rise, land subsidence, storm surges, and/or high tide events.
6	Cyclones	Acute	Maximum Tropical Cyclone Wind Speed (knots)	The maximum sustained wind speed associated with being within 200km of a tropical cyclone, based on cyclone basin-specific tropical cyclone projections generated using AR6 global mean surface temperature projections.
7	Landslides	Acute	Rainfall-Induced Landslides Index (days)	The annual number of days with a potential chance of a rainfall-induced landslide event. This index is developed using the antecedent rainfall index (weighted summation of daily rainfall amounts) and landslide susceptibility (based on slope, faults, geology, forest loss, and road networks).
8	Water Stress	Acute / Chronic	Water Stress (categorical)	Projected water stress estimates the future competition for water resources and is defined as the ratio of demand for water by human society divided by available water.
9	Wildfires	Acute	Forest Fire Danger Index (days)	The annual number of days with fire-permitting climatic conditions. This index is based on the McArthur Forest Fire Danger Index (FFDI; widely used in Australia for several decades) and combines a record of dryness, based on rainfall and evaporation, with meteorological variables for wind speed, temperature, and humidity.

6.9.1.2 STEP 2-CLIMATE DATA COLLECTION

The Physical CCRA uses several data sources, including baseline and projection data. ERM uses baseline data to understand the current presence of each climate hazard within the Project's area. Projections data suggest the potential change (if any) in intensity and frequency of each climate hazard within the Project area under specified future timeframes and climate scenarios.

ERM collects a series of data variables for each climate hazard. This climate data is collected primarily using ERM's CIP and Global Climate Database (GCD) and is supplemented by any climate data provided by the client as well as the best available online sources of data.

Baseline and Projections Data

The baseline and climate projections data are sourced from several leading climate data providers and international scientific organisations, including the Intergovernmental Panel on Climate Change (IPCC), the World Resources Institute (WRI), International Best Track Archive for Climate Stewardship (IBTrACS), Fathom, the National Aeronautics and Space Administration (NASA), the European Space Agency, and the World Bank. The detailed list of datasets used in the current assessment is as follows:

- ISIMIP3b Protocol CMIP6 historical & projections models[198]
- World Resources Institute (WRI) Aqueduct Water Risk Atlas[199]
- World Resources Institute (WRI) Aqueduct Floods (Coastal)[200]
- Fathom (Extreme Rainfall and Riverine Flooding)[201]
- International Best Track Archive for Climate Stewardship (IBTrACS)[202]
- American Meteorological Society[203]
- NASA's Landslide Susceptibility Map[204]
- European Space Agency (ESA) FireCCILT11 project[205]

The climate data used is comprised of various types of datasets including **Observational (baseline only), Modelled,** and **Reanalysis (baseline only)** data.

- **Observational data (baseline only)** is based upon observations recorded and collected at various weather stations located around the world;

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[198] ISIMIP3b Protocol CMIP6 historical & projections models. (n.d.). *ISIMIP3b Protocol*. Retrieved from https://protocol.isimip.org/#/ISIMIP3b
[199] World Resources Institute. (n.d.). Aqueduct Water Risk Atlas. Retrieved from https://www.wri.org/data/aqueduct-global-maps-40-data
[200] World Resources Institute. (n.d.). Aqueduct Water Risk Atlas. Retrieved from https://www.wri.org/data/aqueduct-global-maps-40-data
[201] World Resources Institute. (n.d.). *Aqueduct Water Risk Atlas*. Retrieved from https://www.wri.org/data/aqueduct-global-maps-40-data
[202] International Best Track Archive for Climate Stewardship. (n.d.). *IBTrACS project version 4.01*. Retrieved from https://catalog.data.gov/dataset/international-best-track-archive-for-climate-stewardship-ibtracs-project-version-4-01
[203] Knutson, T. R., et al. (2020). *[Title of the article]*. *Bulletin of the American Meteorological Society, 101*(3). https://doi.org/10.1175/BAMS-D-18-0194.1
[204] Stanley, T., & Kirschbaum, D. (2017). *NASA's Landslide Susceptibility Map*. Retrieved February 11, 2025, from https://gpm.nasa.gov/applications/landslides#modellingandreportinglandslides
[205] European Space Agency. (n.d.). *FireCCILT11 project*. Retrieved from https://geogra.uah.es/fire_cci/fireccilt11.php

- **Modelled data** aims to identify, quantify, and accurately represent complex physical processes within the climate and can be generated in several formats, depending on the physical process being modelled and the differing resolution of models (e.g., Global Climate Models or Regional Climate Models). Modelled climate data can be used to highlight trends in climatic processes under historical (past), present, and projected future climatic conditions[206]; and
- **Reanalysis data (baseline only)** describes the reanalysis of previously recorded climate data, either from observations or modelled records. This data source aims to correct any biases, errors, and aspects of physical climatic processes that were previously unidentified within older iterations of data. These corrections can be carried out via the back testing of data against newly observed climatic trends and/or modelled climate data[207].

Climate Scenarios

The IPCC is the UN's leading body for assessing the science related to climate change. The IPCC provides periodic Assessment Reports (AR) reviewing the available literature on climate change and trends in climatic hazards. Each new AR comes with a new round of climate models and datasets developed by the IPCC and Coupled Model Intercomparison Project (CMIP). ERM utilises the latest round of climate data from the IPCC AR6, published in 2021, which marks the most well-rounded set of published climate data.

Climate models are continually being updated by incorporating higher spatial resolution, new physical processes, and biogeochemical cycles, hence the data provided by CMIP6 shows an improvement compared to the ones provided by CMIP5. CMIP6 also sees a move away from RCPs to SSPs, which aim to bridge the gaps between the physical climate and social sciences and explore the potential future climate response to a broader range of GHGs, land uses, and air pollutants.

Each of the SSPs set out by the IPCC represents scenarios that vary based on future projected GHG emissions and resultant warming over the next century. As GHGs increase, there is the potential that climatic conditions within any given area could also change (e.g., changes in temperature and/or precipitation regimes). However, the specific change experienced for any given area can vary, depending on the prescribed increase in GHG emissions associated with each SSP and time horizon.

The TCFD recommends scenario analysis as a critical tool to understand the strategic implications of climate-related risks and opportunities for an organisation. Scenario analysis enables organisations to examine various hypothetical scenarios that explore a range of global warming levels (from pre-industrial temperatures) and the associated physical, transition, and liability risks that could potentially impact their operations and value chain. The insights gained from scenario analysis can strengthen a company's strategic decision-making, facilitate risk management, and leverage on opportunities arising from the transition to a low-carbon economy.

Disclosing information related to the company's climate change mitigation and adaptation measures for different climate scenarios can enhance transparency and accountability to

[206] NOAA (2021), Climate Models (2022). Retrieved from: https://www.climate.gov/maps-data/primer/climate-models
[207] ECMWF (2021), Climate Reanalysis (2022). Retrieved from: https://www.ecmwf.int/en/research/climate-reanalysis

enable investors and other stakeholders to make informed decisions about the company's exposure to climate-related risks and opportunities.

The TCFD technical guidance on climate scenario analysis recommends the inclusion of scenarios that encompass a range of reasonable outcomes, including:[208]

- **Low-carbon scenario:** A scenario representative of keeping global average temperatures at 2ºC or lower, most closely aligned with the Paris Agreement; and
- **High-carbon scenario:** A business-as-usual (BAU) scenario, where policy commitments do not develop to pursue decarbonisation beyond those enacted today.

The climate scenarios for physical risk are chosen from the IPCC's SSPs[209] as outlined in **Table 6-124**.

TABLE 6-124: CLIMATE PROJECTION SCENARIOS

Scenario	Emission Scenarios	Estimated Temperature Rise (very likely) by 2100
Low Carbon	SSP1-2.6	1.3°C – 2.4°C
High Carbon	SSP5-8.5	3.3°C – 5.7°C

Time Horizons

The time horizons considered in this report align with the TCFD recommendation of selecting:

- A short-to-medium term horizon; and
- A long-term time horizon

The short-to-medium horizon selected for physical risks is '2030'. The year 2030 holds great significance for sustainable development as it represents the year for achieving the targets of the United Nations 17 Sustainable Development Goals (UN SDGs). The UN SDGs were adopted in 2015 by UN member states as a global framework to be attained within a 15-year timeline. Further, '2030' is often the short-term (or interim) target year in countries' Nationally Determined Contributions (NDCs).

Considering the expected operational lifetime of the Project is 20 - 25 years from baseline, an appropriate long-term horizon of physical risks will be '2050'. Hence, the CCRA considers the following periods outlined in **Table 6-125**.

TABLE 6-125: FUTURE TIME HORIZONS CONSIDERED FOR CCRA

Time Horizons	Physical Risk Review
Short-to-medium term	2030
Long-term	2050

[208] Task Force on Climate-related Financial Disclosures (TCFD). (2017). *Technical supplement: The use of scenario analysis in disclosure of climate-related risks and opportunities*. Retrieved from https://assets.bbhub.io/company/sites/60/2020/10/FINAL-TCFD-Technical-Supplement-062917.pdf

[209] Carbon Brief (2018), Explainer: How 'Shared Socioeconomic Pathways' explore future climate change. Retrieved from: https://www.carbonbrief.org/explainer-how-shared-socioeconomic-pathways-explore-future-climate-change/

6.9.1.3 STEP 3-CLIMATE DATA TREND ANALYSIS

Step 3 involves the analysis of baseline and future projected trends for each climate hazard including a review of the potential materiality of any risk present under the baseline conditions, and how this risk could potentially change in the future according to any key trends identified within the climate data. Each climate hazard is assessed concerning the Project using a mixture of climate data provided from the global climate database, extracted from ERM's CIP, and qualitative research that is sourced from industry-leading academic and governmental sources.

Any trends identified in the projected climate data are analysed and interpreted to indicate the potential for a change in the presence and intensity of each climate hazard within the Project area, under two-time horizons (i.e., 2030 and 2050) and for two climate scenarios (i.e., SSP1-2.6 and SSP5-8.5).

6.9.1.4 STEP 4-RISK REVIEW

ERM undertakes a review of the potential risks posed to the Project related to each climate hazard. Climate data is collected and discussed concerning three time periods (baseline, 2030, and 2050).

In CIP, all assets are assigned an 'asset type' from a list of 42 common asset types (e.g., onshore wind, manufacturing & chemicals, real estate: offices, transport: rail, etc.). Following qualitative research, default exposure ratings for each climate hazard were allocated to each asset type available in CIP. These ratings aim to incorporate an asset type's predisposed exposure to physical risk, as shown in **Table 6-126**.

- Exposure ratings consider the significance of each climate hazard on an asset type of operations, supply chain, and market; and
- The exposure ratings are obtained based on an extensive literature review across the various sectors for different regions that includes a review of past projects undertaken by ERM and a range of literature, including Sector/asset-type specific climate risk assessments, company risk assessments, CDP reports, government guidance and reports, financial institution guidance, and scientific papers and news articles on specific events.

TABLE 6-126: EXPOSURE RATINGS IMPACT TABLE

Exposure Rating	Multiplier	Potential Impacts Are Likely to:
Very High	**10**	• Be long-term (possibly permanent), severe and financially significant. • Have extensive social and health implications with national or international reputational impacts. • Affect large areas of the environment over a period of months, impacting high biodiversity areas. • It is likely that the entirety of the overall asset would be impacted.
High	**8**	• Be long-term (months) and financially significant to operations. • Have extensive social and health implications with national or international reputational impacts. • Affect large areas of the environment over a period of months impacting high biodiversity areas. • It is likely that a large proportion of the overall asset would be impacted.

Exposure Rating	Multiplier	Potential Impacts Are Likely to:
Moderate	**6**	• Be medium-term (weeks) and moderately financially significant to operations. • Have minor/medium social and health implications with local reputational impacts. • Affect moderate areas of the environment over a period of weeks, impacting low biodiversity areas. • It is likely that a moderate proportion of the overall asset would be impacted.
Low	**4**	• Be short-term (days) and not financially significant to operations. • Have minimal social and health implications with limited reputational impacts. • Affect small areas of the environment over a short period. • It is likely that a small proportion of the overall asset would be impacted.
Minimal	**2**	• Exposure to the Climate Hazard is minimal with limited potential effects to assets.
N/A	**0**	• Exposure to the Climate Hazard is not relevant with no potential effects to assets.

Risk Scores

A risk score is a quantitative number used to assess the current and projected impacts of physical hazards. This is based on climate data and an asset's exposure rating.

- A high-risk score indicates high exposure to a climate hazard, and/or a high relevance of that climate event type to a particular type of asset; and
- Risk scores can be calculated at each asset for hazard types (i.e., an 'Event Type Risk Score'), or these can be aggregated to obtain an average risk score for the asset (i.e., an 'Asset Risk Score').

Risk scores for individual hazard types are generated using the formula:

$$Risk\ Score_{hazard} = Normalised\ Climate\ Data\ x\ Exposure\ Rating\ Multiplier$$

The normalisation of climate indicators is the process by which raw data on different scales (e.g., flood depth in meters, wind speed in knots, etc.) is converted to a scale of 0 to 1, where 0 represents an absence of a climate hazard, and 1 represents the maximum risk from that hazard. On the other hand, the exposure ratings multiplier represents the potential for a climate hazard to disrupt an asset type's operations, supply chain, and/or market, categorised into N/A, Minimal, Low, Moderate, High, and Very High (for details, see **Table 6-127**). The exposure rating multiplier indicates the level of impact the asset type may experience if faced with each climate hazard. Hence, the exposure rating multiplier embeds both exposure and sensitivity. These two (2) parameters have been identified based on how they may affect individual sectors. Thus, the high-risk score indicates high exposure to a climate hazard and/or a high relevance of that climate event type to a particular asset type.

Asset risk scores are the average of all hazard risk scores for an asset, which can be calculated using the formula:

$$Risk\ Score_{Asset} = \frac{\sum Risk\ Score_{hazard}}{n_{hazard}}$$

Where n_{hazard} is the number of climate hazards for an asset.

Absolute risk scores are calculated for present-day conditions and future projected conditions and can vary from a minimum of 0 to a maximum of 10. Absolute risk scores are categorised using the thresholds in **Table 6-127** for the specific climate hazard or for the overall asset.

TABLE 6-127: CATEGORIES OF ABSOLUTE RISK SCORES

Risk Threshold	Event Type (Hazard) Risk Score Threshold	Asset Risk Score Threshold
Minimal	0 to 1	0 to 1
Low	1 to 2	1 to 2
Moderate	2 to 3	2 to 3
High	3 to 4	3 to 4
Very High	4 to 10	4 to 10

Table 6-128 outlines the thresholds used to identify the magnitude of increase or decrease in each risk score from baseline across future time horizons. For example, if a baseline hazard risk score is 2.0, and the 2050 hazard risk score is 3.5, then the hazard risk score has increased by 1.5 indicating a Moderate Increase. In all cases:

- **Orange** and **red** indicate a minimal and moderate **increase** in the future risk score, with darker red indicating a significant increase.
- **Blue** indicates a **decrease** in the future risk score, with darker blue indicating a larger decrease.

TABLE 6-128: THRESHOLD MAGNITUDE OF RISK SCORES

Risk Score	Change in Score
Significant Decrease	- 2 or below
Moderate Decrease	- 1 to – 2
Minimal Decrease	- 0.25 to – 1
No Change	- 0.25 to + 0.25
Minimal Increase	+ 0.25 to 1
Moderate Increase	+ 1 to + 2
Significant Increase	+2 or above

6.9.2 PHYSICAL RISK FINDINGS

ERM conducted a high-level physical risk screening of seven (7) key locations across the alignment as illustrated in **Figure 6-44** and listed in **Table 6-129** and provided comprehensive findings (in-depth analysis) for the five (5) most vulnerable locations.

FIGURE 6-44: PROJECT SITE MAP FOR THE PHYSICAL RISK ASSESSMENT

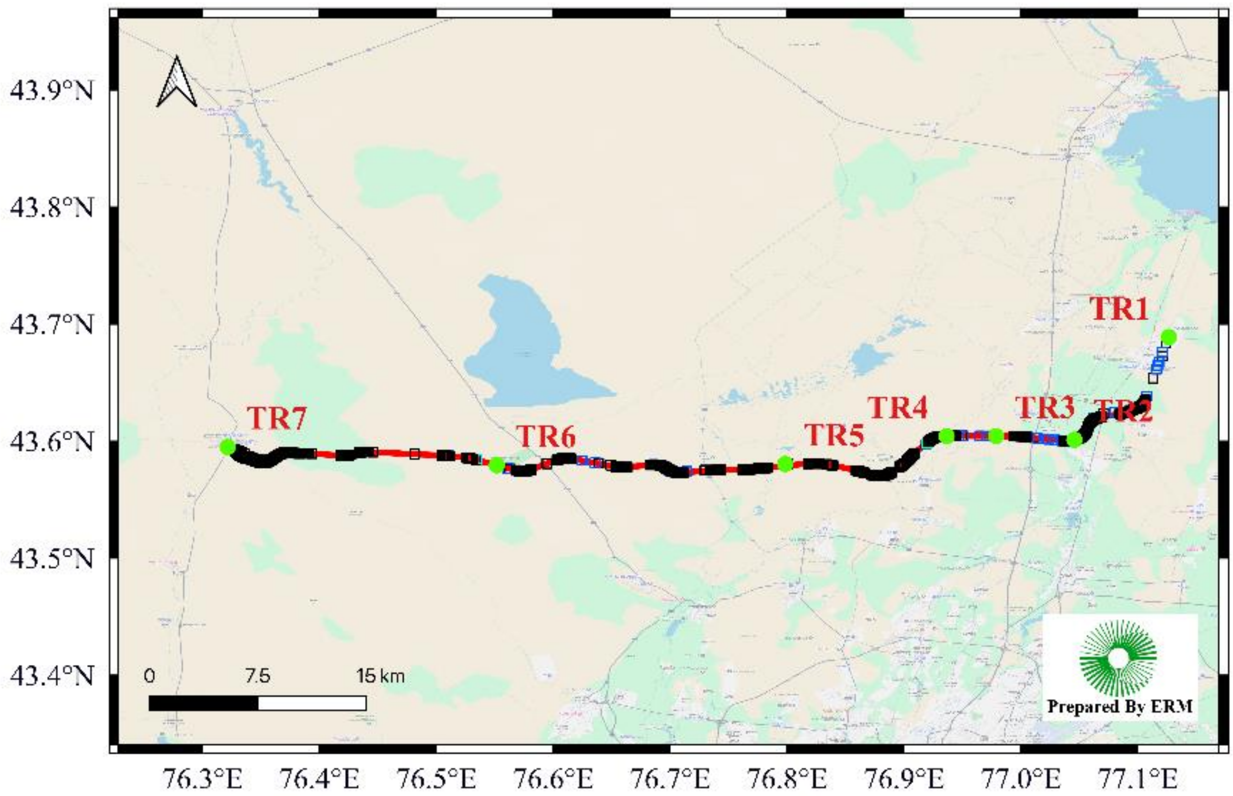


TABLE 6-129: PROJECT'S SITE LOCATIONS FOR THE PHYSICAL RISK ASSESSMENT

No	Asset ID	Latitude	Longitude
1	TR1*	43.688792	77.126553
2	TR2*	43.601142	77.04571685
3	TR3	43.604389	76.978861
4	TR4*	43.604271	76.93652285
5	TR5	43.580503	76.798314
6	TR6*	43.579422	76.551683
7	TR7*	43.594994	76.321478

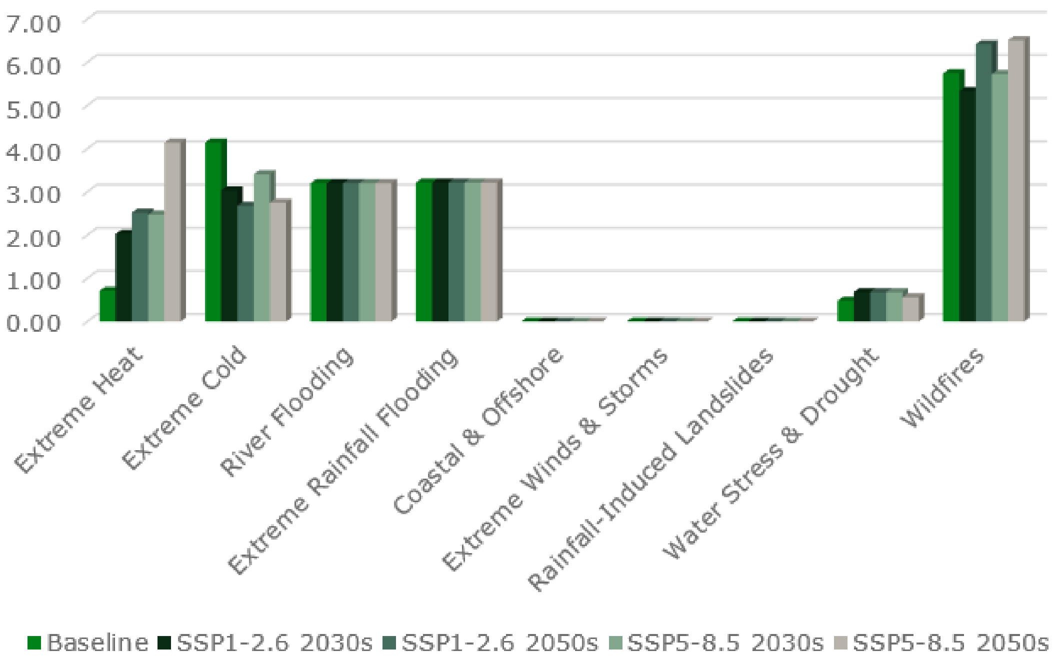
Note: * Conducted a high-level physical risk screening of all seven (7) locations listed above and provided comprehensive findings (in-depth analysis) for the five (5) most vulnerable locations.

The high-level screening reveals that extreme heat and cold are anticipated to affect the Project. However, the locations surrounded by dense vegetation are susceptible to wildfires, while one location exhibits heightened vulnerability to water stress compared to others. Additionally, the hotspot analysis of riverine flooding indicates that it will likely impact specific locations of the Site, whereas the extreme rainfall flooding hotspot analysis suggests that most parts of the Site will likely be impacted by heavy rainfall. The CCRA results are summarised in **Table 6-130**. Risk scores averaged across all locations are shown in **Figure 6-45**.

TABLE 6-130: CCRA RESULTS

S. No.	Climate-Related Risks	Vulnerable Locations
1.	Extreme Heat	Likely to impact the complete Project
2.	Extreme Cold	Likely to impact the complete Project
3.	River Flooding	Likely to impact the vicinity of some locations, especially TR1, TR2, TR4, and TR6 as well as the eastern side of TR7
4.	Extreme Rainfall Flooding	Likely to impact most parts of the Project
5.	Wildfires	Likely to impact the Project locations surrounded by dense vegetation
6.	Water Stress	Likely to impact the complete Project

FIGURE 6-45: RISK SCORES AVERAGED ACROSS ALL LOCATIONS



Overview of the Project's Natural Hazard Assessment and Identified Mitigation Measures

The key findings of this assessment are:

- The **extreme heat** is likely to increase moderately to significantly in future time horizons under the considered scenarios. The risk associated with it is **categorised as "Minimal" during baseline and is projected to become Moderate (Moderate to Very High) by the 2030s (2050s)** under the considered scenarios (i.e., SSP1-2.6 and SSP5-8.5). There are slight differences in the baseline and projected risk scores across the selected locations over the Site. Hence, it is important to implement recommended measures to enhance the resilience of the rail network to extreme heat, ensuring safety, efficiency, and continued economic connectivity.
  - The maximum of daily maximum temperature during the baseline is 40.65℃ and is projected to increase by 3.1℃ in the 2050s under the high emission scenario.
  - The warm spell duration index is 14.68 days in the baseline, and it will likely increase by 2.49 and 3.16 times in the 2030s and 3.27 and 6.31 times in the 2050s under the considered scenarios.
- The extreme cold will likely decrease minimally to moderately in future time frames under the scenarios considered. The extreme cold allied risk is categorised as "**Very High**" during baseline and is projected to become "**High**" by the 2030s and "**Moderate**" by the 2050s under the SSP1-2.6 and SSP5-8.5 scenarios, respectively. Given that the Site is in Kazakhstan, with an annual minimum temperature of 5.8℃ and the minimum of daily minimum temperature of -27.56℃, it poses a significant climate risk to the Site, though the risk associated with it will decrease in future time frames.
  - The minimum of daily minimum temperature during the baseline is -27.56℃ and is projected to increase by 2.56℃ in the 2050s under the high emission scenario.
  - The cold spell duration index is 11.44 days in the baseline, and it will likely decrease by 1.86 and 1.48 times in the 2030s and 2.38 and 2.29 times in the 2050s under the considered scenarios.
- The aggregated risk of **riverine flooding** is **"High" in the baseline and is expected to remain "High" in future time horizons under considered scenarios**. The railroad crosses several rivers like the Kaskelen River, Malaya Almatinka River, etc. and to assess the risk associated with riverine flooding, a buffer radius of 270m is considered around the selected locations. Furthermore, a hotspot analysis is carried out in the following sub-sections to understand the locations susceptible to riverine flooding. Hotspot analysis reveals flooding footprints in the vicinity of considered locations, especially TR1, TR2, TR4, TR6, and the eastern side of TR7. Thus, adaptation measures would be required for those locations.
- The risk of **extreme rainfall flooding** is also **"High" in the baseline and is expected to remain the same in future time horizons under considered scenarios**. To assess the risk associated with extreme rainfall flooding, a buffer radius of 270m is considered around the selected locations. Additionally, a hotspot analysis is carried out in the following sub-sections to understand the locations susceptible to flooding due to heavy rainfall. Hotspot analysis reveals that most parts of the Site are prone to extreme rainfall flooding. Thus, it is expected to implement the recommended measures to make the railroad

resilient to flooding, ensuring continuity in operations and the safety of passengers and goods.

- **Aggregated Water stress**-related risk is "**Minimal" in the baseline and is expected to remain in the same category by the 2030s and 2050s under the considered scenarios.** There is not much difference in baseline and projected risk scores across the selected locations over the Site, except for TR1. The high-level CCRA indicates that TR1 and its nearby surroundings are more vulnerable to water scarcity, suggesting that the demand for water in this area is higher. However, for the remaining locations, the risk associated with it is "**Minimal**." Water stress is expected to pose a minimal risk to rail transport, e.g., less availability will affect the maintenance and cleaning operations, and there might be a health and safety risk for staff and passengers if there is inadequate drinking water supply. Since the railroad is not a water-intensive sector and the water stress aggregated risk score is minimal, it is not expected to cause any material risk to rail transport.
- **Wildfire-associated risk** is based on the number of days with fire-permitting climatic conditions (that considers the record of dryness, rainfall, and evapotranspiration rate, along with meteorological variables for wind speed, temperature, and humidity) and is "**Very High**" in the baseline and is likely projected to be in the same category in the future time horizons, even though the risk associated with it shows a minimal decrease and no change by the 2030s and minimal increase by the 2050s under the scenarios considered. The historical data also conveys burned areas in the vicinity of some selected locations, especially TR4, TR5, TR6, and TR7. Hence, one can't eliminate it as a potential climate risk to the Project.
- The risk of coastal flooding, rainfall-induced landslides, and extreme winds and storms is considered "**Minimal**" in the baseline and is likely to remain the same by the 2030s and 2050s under both scenarios.

The climate risk scores are shown in **Table 6-131**.

TABLE 6-131: CLIMATE RISK SCORES

Event Type	Baseline Risk	SSP1-2.6		SSP5-8.5	
		2030s	2050s	2030s	2050s
Extreme Heat	Minimal (0.71)	2.03	2.52	2.47	4.14
Extreme Cold	Very High (4.14)	3.04	2.68	3.41	2.75
River Flooding	High (3.20)	3.20	3.20	3.20	3.20
Extreme Rainfall Flooding	High (3.22)	3.22	3.22	3.22	3.22
Coastal & Offshore	Minimal (0.00)	0.00	0.00	0.00	0.00
Extreme Winds & Storms	Minimal (0.00)	0.00	0.00	0.00	0.00
Rainfall-Induced Landslides	Minimal (0.00)	0.00	0.00	0.00	0.00
Water Stress & Drought	Minimal (0.48)	0.68	0.68	0.68	0.56
Wildfires	Very High (5.74)	5.33	6.42	5.73	6.51

6.9.3 HOTSPOT ANALYSIS

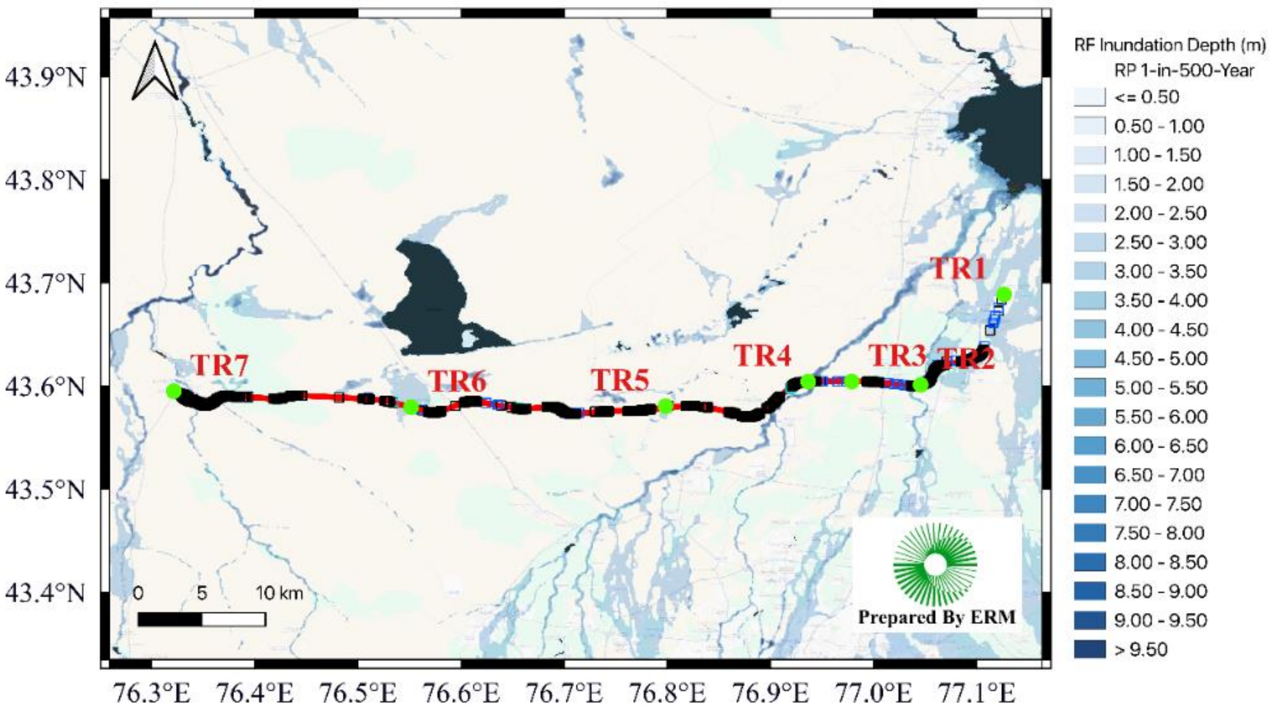
Hotspot analysis involves the systematic identification and assessment of regions that are particularly vulnerable to flood events. The hotspot analysis helps in visualising regions that are at the most significant risk and serves as a critical tool for urban planners, policymakers, and disaster management agencies. These maps facilitate targeted interventions, enabling efficient resource allocation and mitigation strategies to reduce the impact of flooding in vulnerable areas.

6.9.3.1 RIVERINE FLOODING (1-IN-500-Y)

Since the railroad crosses several rivers like the Kaskelen River, Malaya Almatinka River, etc., an in-depth analysis is required to understand regions vulnerable to riverine flooding. Hotspot analysis reveals flooding footprints in the vicinity of considered locations, especially TR1, TR2, TR4, TR6, and the eastern side of TR7 (for details, see **Figure 6-46**).

The riverine flooding inundation depths are based on Fathom-2.0, a global hydrological model. For riverine flooding, a 1-in-500-year return period is considered, and inundation depth is measured in meters. The modelling grid size for riverine flooding inundation is 90m x 90m. Hence, there may be inaccuracies in the spread/severity of the floods due to wider resolution.

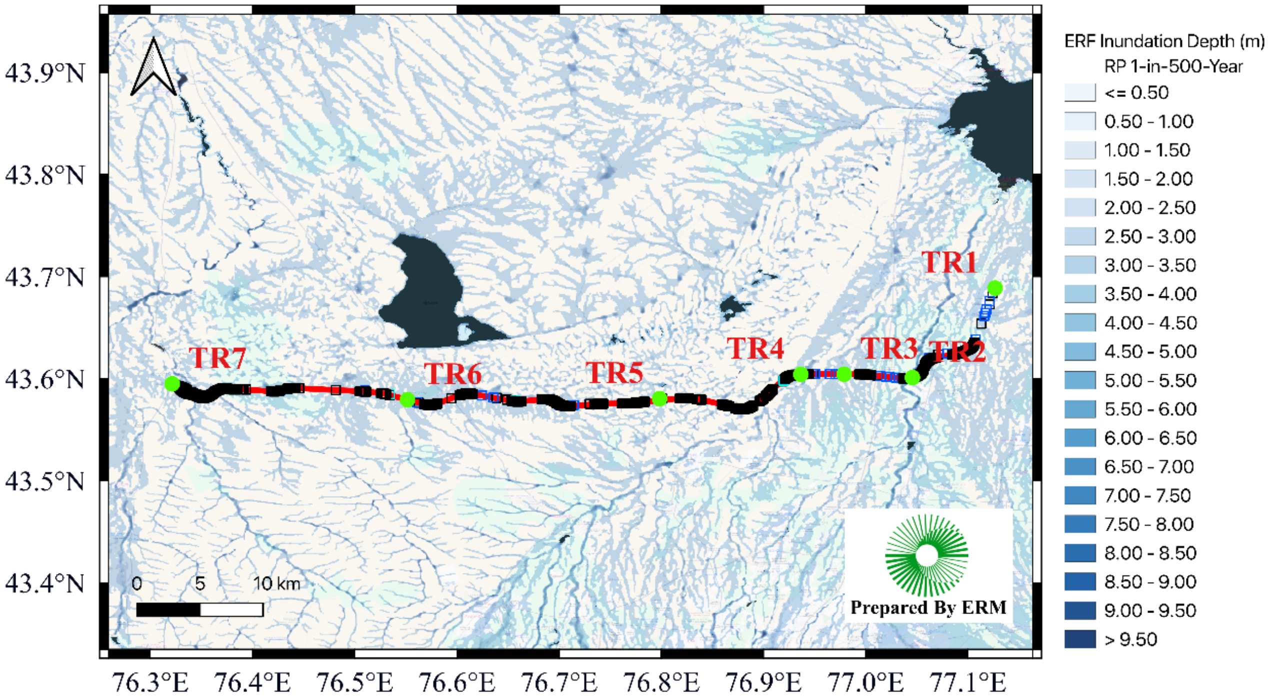
FIGURE 6-46: HOTSPOT ANALYSIS OF THE BASELINE RIVERINE FLOODING (1-IN-500-YEAR)



6.9.3.2 EXTREME RAINFALL FLOODING (1-IN-500-Y)

The hotspot analysis reveals a clear indication of flooding footprints due to extreme rainfall within the vicinity of the railroad (see **Figure 6-47**). The modelling results of the extreme rainfall flooding inundation depth are also based on Fathom-2.0, a global hydrological model. A 1-in-500-year return period is considered for extreme rainfall flooding, and inundation depth is measured in meters. The modelling grid size for extreme rainfall flooding inundation is 90m x 90m. Hence there may be inaccuracies in the spread/severity of the floods due to wider resolution.

FIGURE 6-47: HOTSPOT ANALYSIS OF THE BASELINE EXTREME RAINFALL FLOODING (1-IN-500-YEAR)



6.9.4 BASELINE AND FUTURE PROJECTIONS OF KEY CLIMATIC VARIABLES

Table 6-132 provides the baseline values of crucial climatic variables associated with the hazards identified and how it will change in future time horizons (i.e., 2030s and 2050s) under the considered scenarios (i.e., SSP1-2.6 and SSP5-8.5). The key findings are:

- The maximum of daily maximum temperature during the baseline is 40.65℃ and is projected to increase by 3.1℃ in the 2050s under the high emission scenario.
- The warm spell duration index is 14.68 days in the baseline, and it will likely increase by 2.49 and 3.16 times in the 2030s and 3.27 and 6.31 times in the 2050s under the considered scenarios.
- The minimum of daily minimum temperature during the baseline is -27.56℃ and is projected to decrease by 2.56℃ in the 2050s under the SSP5-8.5 scenario.
- The cold spell duration index is 11.44 days in the baseline, and it will likely decrease by 1.86 and 1.48 times in the 2030s and 2.38 and 2.29 times in the 2050s under the considered scenarios.
- Compared to the baseline, the inundation depth associated with extreme rainfall flooding shows a slight decrease in the 2030s, whereas it shows a minimal increase in the 2050s under the scenarios considered.
- Moreover, the inundation depth associated with riverine flooding slightly increases in future time horizons under considered scenarios, except for SSP5-8.5, 2050.

TABLE 6-132: KEY CLIMATIC VARIABLES OVER TIME HORIZONS AND EMISSION SCENARIOS

Variables	**Baseline**	**SSP1-2.6**		**SSP5-8.5**	
		2030	**2050**	**2030**	**2050**
Warm Spell Duration Index (WSDI) (in Days)	14.68	36.62	47.94	46.34	92.60
Cold Spell Duration Index (CSDI) (in Days)	11.44	6.14	4.80	7.74	5.00
Maximum Daily Maximum Temperature (TXx) (in ℃)	40.65	42.82	43.43	43.21	43.75
Minimum Daily Minimum Temperature (TNn) (in ℃)	-27.56	-27.87	-26.22	-26.41	-25.00
Maximum 1-day Rainfall (Rx1day) (in mm)	26.88	27.19	27.88	28.53	27.62
Maximum 5-day Rainfall (Rx5day) (in mm)	53.71	56.61	57.96	63.98	56.46
Extreme Rainfall Flooding Inundation Depth (in m)	0.91 (0-2.59)	0.90 (0-2.54)	0.94 (0-2.65)	0.90 (0-2.54)	0.95 (0-2.69)
River Flooding Inundation Depth (in m)	1.05 (0 – 3.61)	1.06 (0-3.63)	1.07 (0-3.66)	1.06 (0-3.62)	0.94 (0-3.23)
Extreme Winds & Storms (in knots)	0.00	0.00	0.00	0.00	0.00

Summary and Next Steps

Table 6-133 presents an overview of measures already in place (embedded controls) and recommendations to minimise the residual impacts of hazards on the Site. The following recommendations are designed to enhance resilience and adaptive capacity in the face of growing challenges associated with climate change.

TABLE 6-133: SUMMARY AND RECOMMENDED RISK MITIGATION MEASURES

Climate Hazard	Hazard Category	Risk Area	Potential Impact	Embedded Controls	Residual Risk and Recommendations[210]
Extreme Heat	Acute / Chronic	Associate and Supporting Facilities	Physical damage to assets	• During the rail design phase, temperature fluctuations are considered, and the current design can endure extreme heat exceeding 120°C. • The rail surface is treated with a specialised coating designed to enhance thermal resistance and durability. • Equalising rails have been implemented to facilitate controlled expansion/contraction, thereby reducing stress on the track. Additionally, an expansion gap of 4-5 mm has been established to mitigate damage caused by heat-induced changes. • To ensure track safety and structural integrity, thermal monitoring is already in place, including an ultrasonic flaw detection technique that helps identify internal cracks within the rails. • Additionally, mobile diagnostic units with thermometers are also in place to monitor temperatures continuously, detecting	• Considering extensive measures already in place, the residual impact of extreme heat on the railroad and its operations will likely be **Negligible**. • Additionally, the following measures can be taken into consideration as part of Good International Industry Practice (GIIP): ◦ Ensuring regular inspections and maintenance activities. ◦ Implement speed restrictions and scheduling adjustments to minimise rail expansion effects. ◦ Ensuring carriage-cooling systems are designed to withstand the future projections of extreme temperatures. ◦ Establish Emergency Response Plan for addressing heat-related track deformation, including rapid deployment of maintenance teams.

[210] Federal Railroad Administration. (2024, July). *Rail resiliency bulletin* (FRA Bulletin). U.S. Department of Transportation. https://railroads.dot.gov/sites/fra.dot.gov/files/2024-07/FRA%20Resiliency%20Bulletin%20July%202024_%20PDFa.pdf
Transport Canada. (2022, June 15). *Railway extreme heat and fire risk mitigation rules*. Government of Canada. https://tc.canada.ca/sites/default/files/2022-06/railway-extreme-heat-and-fire-risk-mitigation-rules-june-15-2022.pdf

Climate Hazard	Hazard Category	Risk Area	Potential Impact	Embedded Controls	Residual Risk and Recommendations[210]
				excessive heat buildup that could lead to rail expansion, buckling, or misalignment. • As per the requirement, refrigerated containers are used for temperature-sensitive goods. • To prevent overheating of key infrastructure components (like signals and power systems), materials were selected to endure high temperatures, ensuring that they remain functional even in extreme heat conditions.	
		Site Personnel	Impact on workers	• To ensure workers' safety, work hours are thoroughly regulated during the peak hot season, e.g., heavy labour work is scheduled for early mornings and late evenings, while less intensive or sheltered tasks are carried out during the hottest part of the day. This framework is fully compliant with Kazakhstan's labour laws, prioritising both safety and legal adherence.	• Incorporate heat awareness training programs into the H&S management system/plan to educate employees about heat-related risks and the importance of staying hydrated (if not already included).

Extreme Cold	Acute / Chronic	Associate and Supporting Facilities	Physical damage to assets	• Considering harsh continental climate conditions, extreme temperatures were already factored into the infrastructure's resilience.
				• Materials were selected to endure extreme temperatures, and functionality is unaffected up to ±120°C.
				• Thermal monitoring, including an ultrasonic flaw detection technique that helps identify internal cracks within the rails, is already in place to ensure track safety and structural integrity.
					• Considering measures already in place, the residual impact of extreme cold on the railroad and its operations will likely be **Negligible**.
					• The following measures must be considered during extreme cold conditions as part of GIIP:
					  ◦ Ensuring regular inspections and maintenance activities.
					  ◦ Develop protocols regarding speed reduction in extreme cold conditions to prevent derailments caused by

Climate Hazard	Hazard Category	Risk Area	Potential Impact	Embedded Controls	Residual Risk and Recommendations[210]
				• Equalising rails have been implemented to facilitate controlled expansion/contraction, thereby reducing stress on the track. • As required, insulated/heated containers are used for temperature-sensitive goods. • The rail surface is treated with a specialized coating to enhance thermal resistance and durability.	brittle tracks or reduced braking efficiency. • Apply anti-icing and de-icing agents on tracks to prevent ice buildup.
		Site Personnel	Impact on workers	• Work hours are thoroughly regulated during peak cold conditions to ensure workers' safety, which complies with Kazakhstan's labour laws. • Heating points and breaks are available at the sites for workers. • Additionally, special clothing, shoes, and protective equipment are provided to protect workers from frostbite.	• Incorporate extreme cold awareness training programs into the H&S management system/plan to educate staff on identifying and managing risks of frostbite and hypothermia. • Ensure that O&M plans for stations, depots, and other accessible areas include measures for managing risks of slips during icy weather, e.g., using de-icing agents on walking paths and work areas.

Flooding	Acute	Associate and Supporting Facilities	Physical damage to assets	• The flood risk is considered during the design phase, and to mitigate its impact, the railways were constructed on an embankment.
				• Culverts are in place to manage water flow, and bridges were built for river crossings.
				• To enhance stability, train tracks are slightly raised and supported by a foundation of sand and soil.
				• To prevent waterlogging, drainage infrastructure is in place on both sides of the railway tracks to redirect water to the adjacent fields.
					• Considering extensive measures already in place, the residual impact of flooding on the railroad and its operations will likely be **Low**. To further minimise any residual implications, the following measures can be considered in an ERP:
					  ◦ Stay updated about the weather forecast and river levels to anticipate potential risks.
					  ◦ Ensure regular cleaning of drainage systems, culverts, and embankments to prevent blockages and adequate water flow.

Climate Hazard	Hazard Category	Risk Area	Potential Impact	Embedded Controls	Residual Risk and Recommendations[210]
				• Ballast reinforcement, soil stabilisation, and vegetation processes have already been implemented to minimise soil erosion. • Ensuring the safety of both rail transport and pipelines, railway tracks were already elevated between 2.5m to 3m at locations where they intersect with pipelines, whereas the bridges were constructed at a height of 18m to 19m. • Establish Emergency Response Plan for emergencies like eroded tracks; temporary reinforced rails are installed to allow trains to pass under strict safety conditions.	◦ Deploy rapid response teams for track inspections and maintenance immediately after flooding events. ◦ Implement resilient communication systems to ensure real-time coordination between railway operators and emergency services. • Obtain comprehensive insurance coverage that includes flood damage to mitigate financial risks.
		Site Personnel	Impact on workers	• To ensure safety, workers are prohibited from engaging in tasks in flood-prone areas.	• Develop Emergency Response Plans (ERP) outlining specific actions to be taken during flood events, for e.g. training staff on emergency procedures and conducting regular drills to ensure readiness.
Wildfires	Acute	Associate and Supporting Facilities	Physical damage to assets	• In case of emergency, measures like deployment of fire trains at the Site are already in place. • To prevent wildfires, the dry vegetation or wood along the tracks is burnt in a controlled manner. • No fire detection system/sensors are in place. Currently, the train drivers of passing trains inform the station masters of the nearest station about the fires. • Fire extinguishers, both stationary and mobile, are in place on-site to prevent fires.	• Considering the measures already in place, the residual impact of wildfires on the railroad and its operations will likely be **Moderate**. To further minimise the residual impact, the following mitigation measures need to be considered: ◦ Conduct a feasibility study of installing smoke detection systems along railway tracks and, if possible, install these systems to provide early warnings of approaching wildfires. ◦ Ensure the inclusion of regular clearing of dry vegetation around the

Climate Hazard	Hazard Category	Risk Area	Potential Impact	Embedded Controls	Residual Risk and Recommendations[210]
				• Further, to enhance safety measures, fire-resistant materials, particularly concrete, are used for construction purposes. • To reduce risk of wildfires, mineralised strips (composed of bare soil or non-combustible materials) have already been implemented, which act as a firebreak, preventing wildfires from reaching or spreading beyond railway tracks.	tracks in the maintenance plan and maintenance schedule. ◦ If not planned yet, map locations of firefighting capacity and identify responders and response times for different sections of the alignment in the emergency response plan.
		Site Personnel	Impact on workers	• To ensure safety, workers are prohibited from engaging in tasks in affected areas. • Technical training sessions are conducted regularly to practice actions, use of PPE, and firefighting skills.	• Wildfire emergency scenarios, along with staff training and passenger evacuation procedure requirements, should be included in the ERP.

7. SOCIAL IMPACT ASSESSMENT

The Social Impact Assessment (SIA) evaluates impacts caused by the Project's land and natural resources footprint (among other impacts), within the identified social area of influence (SAoI) with a focus on involuntary resettlement of private landowners, leaseholders, agricultural workers, and local communities. It aims to identify stakeholder-specific impacts as well as overarching social impacts for project affected communities and proposes mitigation measures aligned with the local socio-economic context as well as the current project lifecycle (i.e. where land acquisition is nearing completion and where project construction is at an advanced stage).

7.1 ASSESSMENT METHODOLOGY

The social impact assessment is based on the methodology provided in **Section 5.**

The approach to the Social Impact Assessment (including the retrospective construction of a social baseline) takes into consideration the following factors:

- Land acquisition is at an advanced stage and is likely to be completed by early to mid-2025.
- Construction activities commenced in November 2023, and as of January 2025, early works as well as earthworks have been undertaken across the entire alignment.
- No socio-economic baseline or household survey has been conducted for the owners and/or users of the affected land plots (private and/or government) by either KTZ or the Akimats.
- The available information on the affected land plots lists the ownership of the plot (i.e. private and/or KTZ/other institutional entity and/or state or government-owned) names of the entities associated with each plot, area impacted, l and use prior to acquisition, total compensation and status of acquisition. For 274 land plots, this information is available, though 39 were later transferred to Alatau City. However, the exact number of land plots officially transferred remains unclear, as the KTZ-issued list of affected plots may not be fully up-to-date or comprehensive. Additionally, for 49 land plots (including 39 transferred to Alatau City and 10 not listed in the original 274), we only have cadastral numbers, landowner names, addresses, type of ownership, affected area, and total plot area, but no status information.

7.2 DATA COLLECTION METHODS

The following methods were used to collect data to inform this SIA.

Secondary data collection:

- Desktop reviews of Kazakhstan's land-use laws, demographics and baseline socio-economic data.
- Desktop reviews of Project documents made available to ERM by KTZ and the Client. The key documents referred to in this SIA include:
    - IFC Gaps Analysis Report Annex 5 (contains the list of land plots to be procured by the Project)
    - Project alignment and boundaries, including right of way as issued by KTZ
    - The National EIA (InTech, 2023)

On-site primary data collection via stakeholder consultations:

- A stratified, targeted sample of impacted entities was selected between the affected districts of Iliy, Talgar, Zhambyl and Karasay to understand the nature of Project impacts, particularly due to its land requirement, on Project-affected entities. SSIs were then coordinated by District Akimats, KTZ and ERM. Between 28 October and 5 December 2024, ERM conducted 56 stakeholder consultations[211], including:
- Four (4) Focus group discussions with vulnerable groups[212] and impacted populations.
- Ten (10) key informant interviews with local authorities, valuators, cultural heritage site experts and Project representatives.
- 31 semi-structured interviews (SSIs) with the entities impacted by land acquisition including landowners, leaseholders and commercial enterprises.
- 11 ad-hoc stakeholder consultations with impacted residents, agricultural workers, livestock workers, landowners, tenants, subcontracted workers and railway workers.

Additional on-site primary data collection to address Supplementary ESIA data gaps, land acquisition impacts, and physical displacement:

Following the first round of SSIs conducted between 28 October and 5 December 2024, additional stakeholder engagements were undertaken between 15 January and 25 January 2025 to verify displacement cases, gather further information on land use impacts, and address Supplementary ESIA data gaps. The engagements undertaken include:

- One (1) key informant interview with the Alatau City Land Department Representative.
- Eighteen SSIs with affected landowners (including five (5) for physically displaced households) as identified and arranged by the Alatau City Land Department[213].
- A preliminary screening and enumeration of 22 structures marked by KTZ as affected (through visual observation[214]), including two (2) ad hoc semi-structured interviews with affected residents.
- One (1) meeting with KTZ and Integra for data clarifications regarding the Project.
- One (1) meeting with Poligram for design clarifications regarding the Project.
- A site visit to Quarry 20B for visual observations on land use around the quarry.
- A site visit to the 1.961km stretch between Zhana Arna substation and the PS Alma-500 substation for observations on land use for the overhead transmission line that will run between the two substations.

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[211] The original sampling methodology included provisions for engaging landowners who had donated land. However, none were identified during fieldwork. Additionally, field constraints on consultations prevented full alignment with the original sampling methodology, limiting opportunities to engage this group.

[212] KIIs were conducted with the District Akimats to inform the criteria used to understand 'vulnerability" in the local context. While detailed analysis on the Project impacted entities and populations will be presented in detail in the Livelihood Restoration Plan, early insights are included in this Supplementary ESIA.

[213] Of the SSIs arranged by the Land Department in January 2025, three respondents were associated with land plots which had been previously covered through the first round of SSIs conducted in October to November 2024. The data collected pertaining to these three land plots served as supplementary data to the data collected in the first round of SSIs.

[214] The Alatau City Land Department Representative showed markers in red paint which KTZ had left on affected structures in the area. As no confirmed boundaries were available, the visual assessment on site was based on these markers left by KTZ.

Field surveys and observations:

Validation of land ownership and use patterns during alignment drive-throughs to understand livelihood dependencies.

7.2.1 LIMITATIONS TO DATA COLLECTION FOR THE SOCIAL BASELINE AND IMPACT ASSESSMENT

The establishment of the social baseline is crucial for understanding pre-existing conditions in the Social Area of Influence (SAoI) and for accurately predicting potential social impacts associated with the Project. However, several limitations were encountered during the data collection and analysis process that may affect the comprehensiveness of the baseline presented.

- **Limited data in the National EIA**

  The National EIA previously conducted had limited data on the socio-economic conditions of the affected communities as the national regulations do not require the establishment of a social baseline pre-Project construction. This limitation was compounded by the commencement of construction activities along most of the alignment, prior to the commissioning of this Supplementary ESIA.

- **Lack of Granularity in Socio-Economic Data:**

  While secondary data is available at the district and regional levels, there is a notable lack of detailed socio-economic information at the village and rural district levels. This limitation restricts the ability to capture localised dynamics and trends that could significantly influence the assessment of social impacts within the SAoI. Consequently, the reliance on broader district-level data may obscure critical nuances and specific community concerns.

- **Timing of Data Collection:**

  The social baseline was established during a period when the Project was already under construction (as noted in **Section 5**). This timing may have influenced stakeholder perceptions and responses, potentially skewing insights into community sentiment regarding the Project. Additionally, ongoing construction activities may have led to temporary socio-economic changes (e.g., increased employment opportunities, disruptions) that complicate the assessment of baseline conditions.

- **Sampling Bias:**

  Although semi-structured interviews and focus group discussions were conducted with a variety of stakeholders, the selected samples do not represent the diversity of experiences and views within the affected population. The sample was meant to cover affected people from the identified categories (based on the status of land acquisition and issues encountered: fragmentation, land swaps, no-compensation for leased land, and on-going court cases). While the sample is not representative and is instead targeted in nature, the intention is to better understand the compensation process, status, alignment with IFC PS5 and assess gaps, to address residual impacts in the Livelihood Restoration Plan (LRP).

  Additionally, the selection of affected entities for the semi-structured interviews (SSIs) was facilitated by the Alatau City Land Department, who arranged all interviews within a tight timeline. Unlike other engagements where pre-defined categories were used for selection, ERM was unable to provide categorisation criteria in this instance, as the Alatau City Land Department could not supply a cadastral map or equivalent reference. Attendance was further contingent on the willingness of those selected to participate, which may have introduced an additional layer of bias in the responses gathered.

- **Changes in Land Use and Ownership**:

  The ongoing process of land acquisition for the Project may result in changes in land use and ownership that could be evolving. These changes create a dynamic context that is challenging to quantify and accurately reflect within the baseline assessment. For example, at the time of writing, the ERM team was informed of a change in the Project alignment, specifically for the Zhetygen Station, which will lead to physical displacement. The SIA has included physical displacement impacts basis the information made available during the additional site visit from 15 to 25 January 2025 after additional land had been identified for acquisition for the Project.

- **Limited Temporal Scope of Surveys:**

  The assessments conducted primarily represent a snapshot of the socio-economic conditions at a specific point in time. The dynamic nature of social, economic, and environmental factors means that the baseline conditions could evolve rapidly, potentially rendering certain aspects of the baseline assessment for the operational phases.

- **Changes in Project Design:**

  At the time of writing, the Project design and the Project footprint is yet to be finalised[215]. ERM had not received up-to-date Project boundaries as of the January 2025 site visit. Hence, the assessment is based on the latest version of the Project footprint and RoW information which ERM has received from KTZ (3 December 2024), which may be subject to further change after the issuance of this assessment. This may be of particular significance as design changes may result in additional physical displacement, other than the ones identified on the basis of the affected structures marked by KTZ around Zhetygen Station, a category of impacts that has thus far been largely avoided in the project.

- **Stakeholder Engagement Limitations:**

  Although efforts were made to engage a wide array of stakeholders, the voluntary nature of participation could mean that only those with strong opinions—either positive or negative—may have chosen to engage. Consequently, the views of stakeholders less inclined to participate may not be adequately represented, potentially leading to gaps in understanding community concerns.

- **Social Tensions in Talgar:**

  ERM was unable to conduct semi-structured interviews (SSIs) in Talgar with households or entities impacted by the Project’s land procurement due to ongoing social tensions in the district, and restrictions imposed on social gatherings as informed by the District Akimat of Talgar. The analysis for impacted entities in Talgar District instead focuses on land plots in Iliy District with similar characteristics in terms of ownership and land use and relies on key informant interviews conducted with the Talgar Land Acquisition Department and a land valuator based in the district. However, while SSIs could not be conducted in Talgar,

[215] As of the time of writing, georeferencing discrepancies, closed boundary clarifications, and the absence of georeferenced layouts for certain project components remain unresolved. These technical issues have impacted the ability to confirm final project boundaries in a format usable for standard GIS platforms or Google Earth. ERM had flagged these gaps to KTZ, and the resolution of these issues may affect the final assessment of project impacts, including land acquisition and displacement considerations

interviews were successfully conducted for those transferred to Alatau, ensuring that some representation of affected entities was captured.

- **Transfer of Land Parcels to Alatau City:** Alatau City was established in January 2024, in the midst of the process of land acquisition for the Project. A portion of the land parcels acquired (or planned to be acquired) which were under the jurisdiction of the Talgar and Iliy Akimats were be transferred to the new Alatau City Akimat. While information on the land plots to be acquired in Alatau City was made available on 13 January 2025, no further information on the status of land acquisition or the profile of the owners and/or users were available due to the limited information the newly established administration possessed. The land plots which will be transferred to Alatau city will likely be urban in character while this assessment is based on a primarily rural context. Further assessments will need to be conducted to better understand the potential social impacts of the Project in an urban setting, particularly with the establishment of Alatau City, and the transfer of affected land plots to that District.
- **Data Discrepancies**: Of the semi-structured interviews (SSIs) arranged by the Alatau Land Department, eight (8) respondents were not included in the list of 49 land plots provided by KTZ. This suggests that the list given by KTZ may not be fully up to date or comprehensive. It also indicates possible inconsistencies in official records regarding the extent of land acquisition. Further verification with relevant authorities is necessary to reconcile these discrepancies.
- **Limited Coverage of Tenants**: While neighbours mentioned leaseholders potentially facing displacement, none of the leaseholders interviewed were identified as facing physical displacement. However, during the door-to-door survey, neighbours reported that some tenants may be physically displaced. Since no tenants at risk of displacement were directly interviewed, this limits the ability to fully assess the impact on non-landowning residents.

7.3 SUMMARY OF THE SOCIO-ECONOMIC BASELINE OF THE AOI

This section presents an overview of the socio-economic conditions in the SAoI based on the primary and secondary data collection described in **Section 5**.

This section outlines the socio-economic profile of the SAoI. It includes the following:

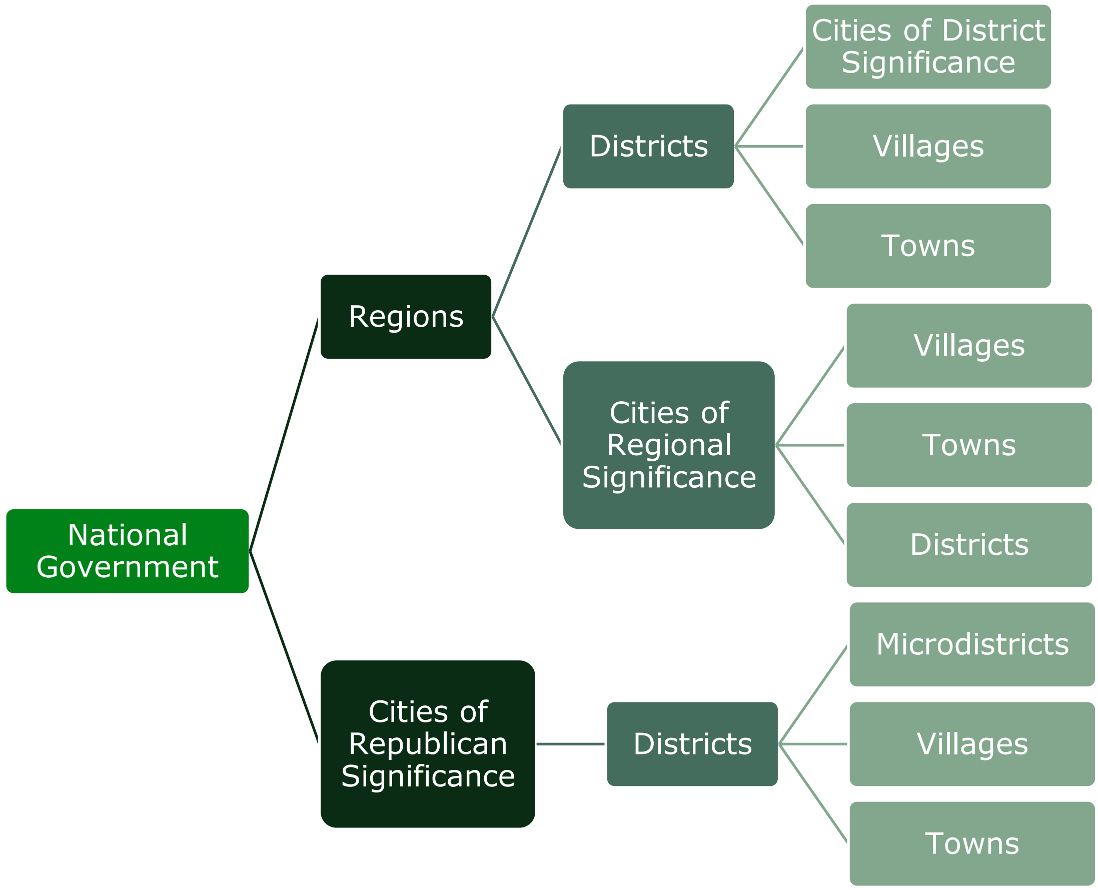
- Administrative Divisions;
- Demographic Profile;
- Vulnerable Groups;
- Infrastructure and Public Services;
- Land Use and Land Ownership; and
- Livelihoods and Local Economy.

7.3.1 ADMINISTRATIVE DIVISIONS

Kazakhstan, located in Central Asia, has a complex administrative structure. The country is divided into the following administrative divisions: regions (*boys*), cities of republican significance and the capital city. The various levels of administration within Kazakhstan are described in **Figure 7-1.**

As of 2024, the Republic of Kazakhstan comprises of 17 regions, 188 districts, 89 cities including three (3) cities of republican significance, 20 townships, 2,169 rural areas and 6,256 villages. According to the Department of Statistical Registers and Classifications, the region with the largest number of districts is Akmola, while the Karaganda region has the greatest number of cities of regional significance and villages[216].

FIGURE 7-1: ADMINISTRATIVE UNITS IN KAZAKHSTAN



The administrative units and terms used in the Republic of Kazakhstan for the classification and management of its territory and settlements are described in **Table 7-1**.

TABLE 7-1: GLOSSARY OF ADMINISTRATIVE TERMS IN KAZAKSHTAN

Administrative Unit	**Description**
Region	Regions comprise of several settlements.
Settlement	Urban settlements include cities of republican significance, cities of regional significance and cities of district significance.
	Rural settlements describe all other settlements.

[216] Department of Statistical Registers and Classifications. (2024). *Administrative-territorial units of the Republic of Kazakhstan (as of July 1, 2024)*. Retrieved 5 December 2024, from https://stat.gov.kz/en/industries/social-statistics/demography/publications/207830/

Administrative Unit	Description
Cities of republican significance	Cities of republican significance are urban settlements deemed to be of special national importance, or which has a population of more than 1 million people.
Cities of regional significance	Cities of regional significance refer to large economic and cultural centres with a developed industrial and social infrastructure. They have a population of more than 50,000 people.
Cities of district significance	Cities of district significance are urban settlements which house industrial enterprises, public utilities, state housing stock, a developed network of educational and healthcare organisations, cultural, educational and commercial facilities. They have a population of at least 10,000 people.
District in the city	A district in the city refer to a district within a city of regional significance or city of republican significance, with a population of over 4,000 people.
Towns	Towns are settlements with a population of at least 3,000 people.
Villages	Villages are settlements with a population of at least 50 people.

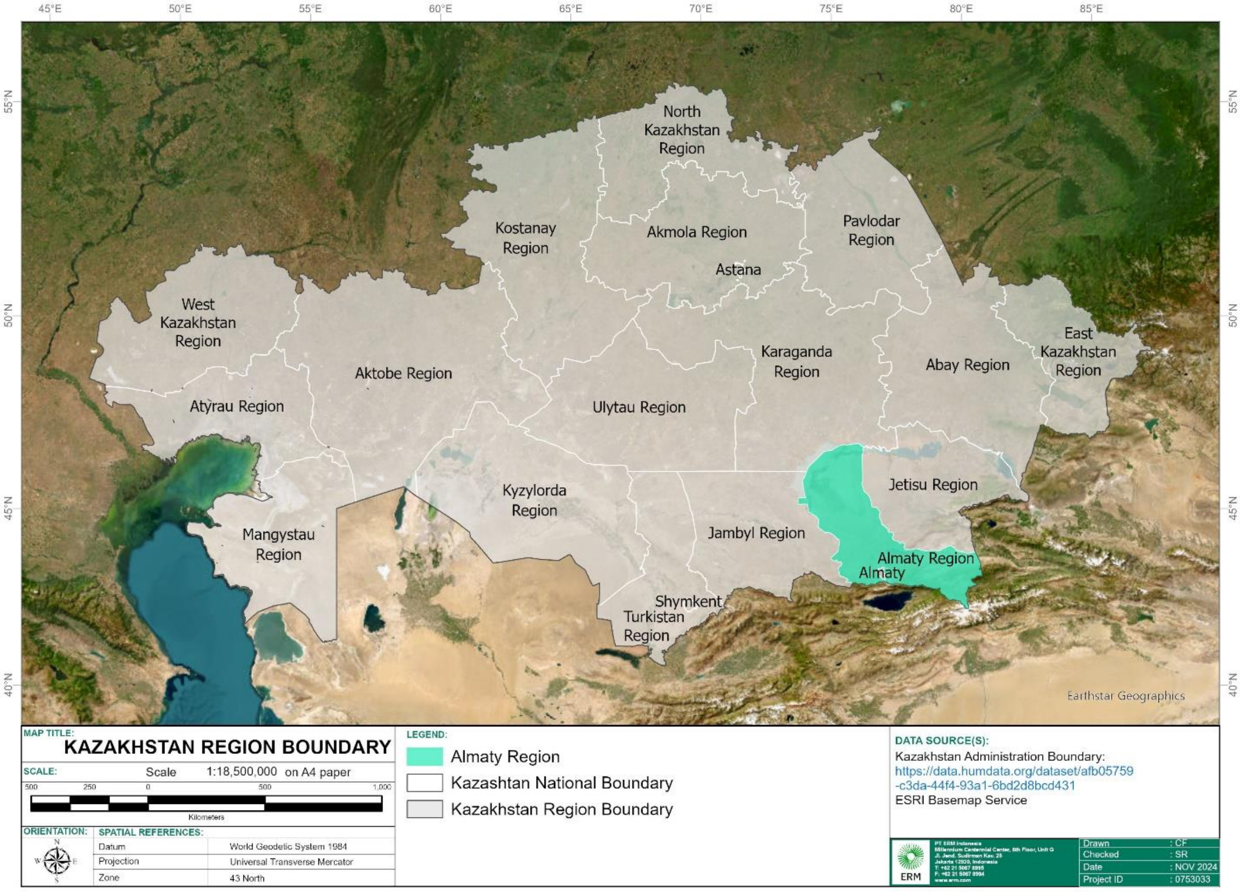
7.3.1.1 REGIONS (*OBLYSY*) AND CITIES OF REPUBLICAN SIGNIFICANCE

Regions are defined as a part of the territory of the Republic of Kazakhstan, including several settlements, formed and managed in the interests of the Republic of Kazakhstan. Cities of republican significance are settlements of special national importance or population of more than one million people[217]. Administratively, regions and cities of republican significance report to the national government.

Figure 7-2 describes the 17 regions in Kazakhstan, and the Project SAoI is within Almaty region located at the south-east of the country, indicated in blue in the map.

[217] Department of Statistical Registers and Classifications. (2024). *Administrative-territorial units of the Republic of Kazakhstan (as of July 1, 2024)*. Retrieved 5 December 2024, from https://stat.gov.kz/en/industries/social-statistics/demography/publications/207830/

FIGURE 7-2: KAZAKHSTAN REGIONS



The SAoI is located within the region of Almaty. The region's administrative centre is the city of Sonae. As of 1 October 2024, Almaty Region had a population of approximately 1,551,400 people, with 19.5% residing in urban areas and 80.5% in rural locales.

7.3.1.2 DISTRICTS

Districts sit under the regions' administrative level. Within Kazakhstan, there are 192 districts spread across the 17 regions: four (4) are districts in cities of regional significance while 18 are in cities of republican significance.

Within the region of Almaty, there are nine (9) districts and two (2) cities of regional significance. They are:

- Konaiev (city of regional significance);
- **Alatau (city of regional significance)**;
- Balkhash;
- Enbekshikazakh;
- **Zhambyl**;
- Kegen;
- **Karasay**;
- Rayymbek;
- **Talgar**;

- Uigur; and
- Ile (formerly known as Iliy). [218]

Of these districts, Konaiev and Alatau are both cities of regional significance. Konaiev hosts key governmental institutions and administrative offices such as the Akimat of Almaty Region and the Akimat of Konaiev City while Alatau is envisioned to become a major economic hub, attracting both domestic and foreign investments. The Akimat of Almaty Region is the executive body responsible for the implementation of state policies in the region, the coordination of local governments and overseeing economic and social development initiatives within the region[219].

Alatau City

The city of Alatau was established this year, in January 2024 and was formerly the village of Zhetygen in the Iliy district of the Almaty region.[220] Plans include the development of infrastructure to support industries such as finance, education, healthcare, and tourism[221]. The government has expanded the local Special Economic Zone (SEZ) from 30,000 hectares to 96,500 hectares and renamed it the Alatau SEZ. This expansion aims to facilitate over 170 projects across various economic sectors, potentially creating approximately 110,000 new jobs[222].

Karasay District

This district is situated to the east of Almaty and is known for its rapidly developing urban areas and residential communities. The Karasay District comprises of the city of Kaskelen, the administrative centre of the district and 46 villages within ten (10) rural districts. The district has a significant agricultural sector and serves as an important area for regional trade due to its proximity to Almaty City.

Zhambyl District

The district comprises of its administrative centre in Uzynagash, 61 villages and 24 rural districts, of which ten (10) rural districts consist of only one (1) independent settlement. Located to the south of Almaty, Zhambyl is predominantly rural with a large part of its economy based on agriculture and livestock.

Iliy District: The administrative centre of the district is Otegen Batyr. There are nine (9) rural districts and 22 villages within the Iliy districts, of which two (2) are independent settlements. This district lies to the northeast of Almaty and is characterized by a mix of agricultural and light industrial activities. It is also known for its strategic importance and connection to both Almaty city and neighbouring regions.

Talgar District: The administrative centre of the district is the city of Talgar. Within Talgar, there are ten (10) rural districts, of which one (1) is an independent settlement. The

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[218] Referred throughout the document as Iliy to maintain naming consistency.
[219] Government of the Republic of Kazakhstan. (n.d.). *Akimat of Almaty Region*. Retrieved 2 December 2024, from https://www.gov.kz/memleket/entities/almobl?lang=en
[220] Sakenova, S. (2024). *Kazakhstan welcomes new town—Alatau*. Retrieved 2 December 2024, from https://astanatimes.com/2024/01/kazakhstan-welcomes-new-town-alatau/
[221] Temirgaliyeva, A. (2024). *Kazakhstan's new city Alatau – What changes are expected*. Retrieved 2 December 2024, from https://en.inform.kz/news/kazakhstans-new-city-alatau-what-changes-are-expected-205378/
[222] The Times of Central Asia. (2024). *New city, Alatau, established in Kazakhstan*. Retrieved 2 December 2024, from https://timesca.com/new-city-alatau-established-in-kazakhstan/

remaining nine (9) rural districts further comprise of 45 villages. Positioned to the southeast of Almaty, Talgar is renowned for its mountainous terrain and vibrant cultural heritage. The district benefits from its proximity to nature and is popular for tourism and outdoor activities, attracting both locals and tourists. Notably, it features the Talgar Pass, a significant transportation route through the mountains.

Table 7-2 summarises the administrative-territorial units discussed within the five (5) districts in the SAoI.

TABLE 7-2: SUMMARY OF ADMINISTRATIVE-TERRITORIAL UNITS WITHIN THE SAOI

District	No. of Cities of Regional Significance	No. of Cities of District Significance	No. of Rural Districts	No. of Villages
Alatau City	1	0	0	0
Karasay	0	1	10	46
Zhambyl	0	0	24	61
Iliy	0	0	9	22
Talgar	0	1	10	45

Source: Department of Statistical Registers and Classifications. (2024). *Administrative-territorial units of the Republic of Kazakhstan (as of July 1, 2024)*. Retrieved 5 December 2024, from https://stat.gov.kz/en/industries/social-statistics/demography/publications/207830/

7.3.2 DEMOGRAPHIC PROFILE

Key baseline information to consider the demographic situation in the settlements listed is presented below:

- Population size and growth
- Migration patterns
- Gender distribution
- Ethnic distribution

7.3.2.1 POPULATION SIZE AND GROWTH

In the Republic of Kazakhstan, the total population was reported to be 20,223,218 in 2024[223]. In total, Kazakhstan comprises of 192 districts and 6327 settlements. Between the years 2021 to 2024, the population increased by 6.11%, with an average year on year growth of 1.83%. There was a noticeable increase in population in 2022 in comparison to 2021 (**Table 7-3**). This is likely attributed to an increase in the number of immigrants and decrease in the number of emigrants after the COVID-19 pandemic as restrictions were lifted and socio-economic activities resumed.

TABLE 7-3: POPULATION GROWTH IN KAZAKHSTAN

Year	Population in Kazakhstan	Change in Population Compared to Previous Year
2021	18,879,552	1.32%

[223] Source: Department of Population Statistics. (2024). *Population of the Republic of Kazakhstan by gender and type of locality (as of 1 October 2024)*. Retrieved 4 December 2024, from https://stat.gov.kz/en/industries/social-statistics/demography/publications/238285/

Year	Population in Kazakhstan	Change in Population Compared to Previous Year
2022	19,503,159	3.31%
2023	19,766,807	1.35%
2024	20,033,842	1.35%

Source: Department of Population Statistics. (2024). *Population of the Republic of Kazakhstan by gender and type of locality (as of 1 October 2024)*. Retrieved 4 December 2024, from https://stat.gov.kz/en/industries/social-statistics/demography/publications/238285/

The population within the SAoI has generally increased more quickly than the population growth in the country of Kazakhstan. Across the four districts, i.e. Karasay, Zhambyl, Iliy and Talgar, the population grew by 10.72% between 2021 and 2024. This is likely due to in-migration from other districts, in anticipation of job opportunities or economic opportunities due to the expansion of the SEZ in the region, as well as the establishment of Alatau City and its planned infrastructural developments. **Table 7-4** describes the population and number of settlements within each district in 2021 and in 2024.

TABLE 7-4: DISTRICT POPULATION

District	2021 Population	2024 Population	Population Change (%)
Alatau City	Not applicable	52,346	Not applicable
Karasay	307,870	349,316	13.46
Zhambyl	163,052	169,999	4.26
Iliy	254,827	232,699	-8.68
Talgar	228,232	251,901	10.37

Source: Department of Population Statistics. (2024). *Population of the Republic of Kazakhstan by gender and type of locality (as of 1 October 2024)*. Retrieved 4 December 2024, from https://stat.gov.kz/en/industries/social-statistics/demography/publications/238285/

The Karasay district recorded the most population change, with a growth of 13.46% between 2021 and 2024. Similarly, the population grew by 10.37% in the Talgar district.

In comparison, the Zhambyl district recorded a smaller growth of 4.26% in its population. This may be due to the predominance of agricultural and livestock activities in Zhambyl and its relative distance to the city of Almaty, leading to less in-migration associated with infrastructural and industrial development to the district in comparison to Karasay and Talgar.

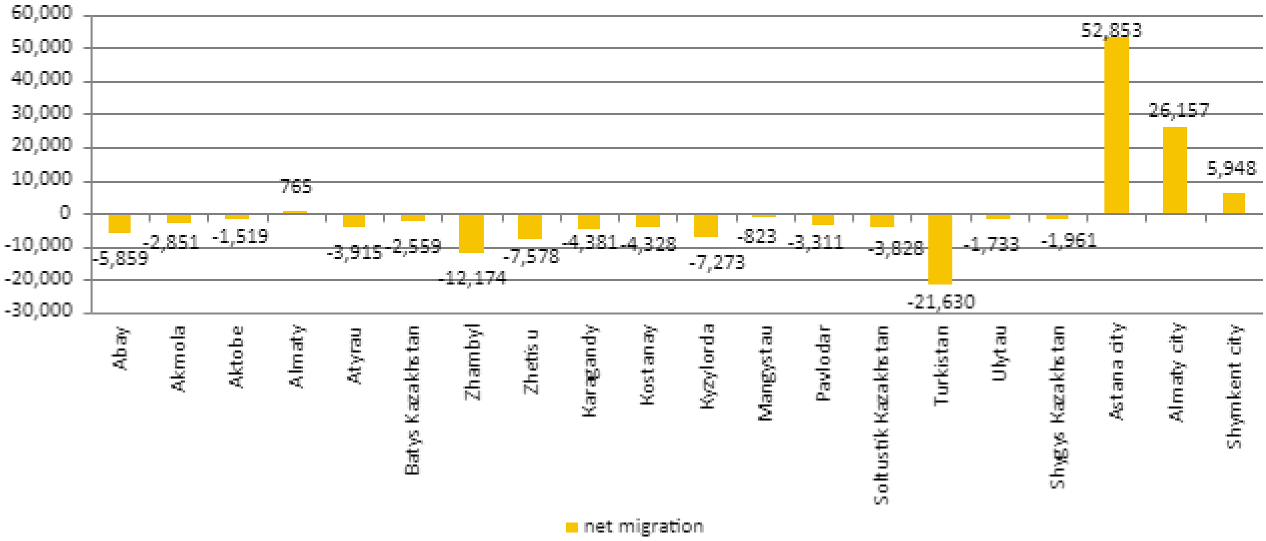
The Iliy district recorded a negative change in its population, with an 8.68% contraction between 2021 and 2024. This is likely due to the former village of Zhetygen being given the status of Alatau City in January 2024, leading to a contraction in the population of Iliy since it was now reported as two administrative units.

7.3.2.2 MIGRATION PATTERNS

The majority of migration activity in the country involves exchanges with Commonwealth of Independent States (CIS) countries. Specifically, 79.7% of incoming migrants originated from CIS countries, while 76.9% of outgoing migrants moved to these nations.

Across Kazakhstan, there are general patterns of intraregional migration towards the cities of Astana, Almaty and Shymkent, as well as the Almaty region (**Figure 7-3**[224]).

FIGURE 7-3: MIGRATION IN KAZAKHSTAN



Within the Almaty region, there has been an overall positive net migration of 765 persons between January to September 2024. Almaty is the only region in Kazakhstan to have achieved net in-migration.

7.3.2.3 GENDER AND AGE DISTRIBUTION

Gender Distribution

The proportion of women within the country of Kazakhstan is marginally higher than the number of men: 48.86% of the population in Kazakhstan are men while 51.14% of the population in Kazakhstan are women. The population in the Almaty region and the districts within the region demonstrate similar characteristics in relation to the gender and age structure.

Age Structure

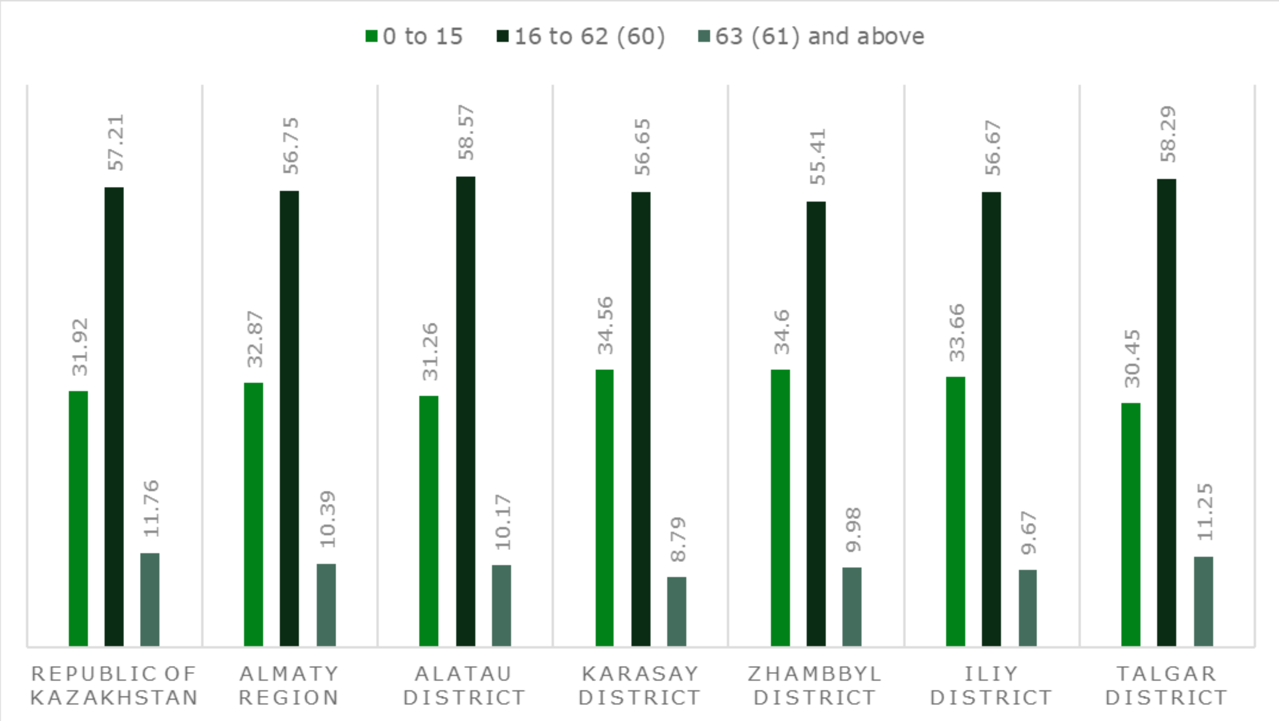
Figure 7-4 represents the age distribution in the SAoI districts as compared to Almaty Region and Kazakhstan. The Almaty Region has a similar age structure to that of the national average across Kazakhstan. The age structure of Alatau City and the four districts Karasay, Zhambyl, Iliy and Talgar are broadly similar, though there are small differences in actual proportions of its populations between each age group.

Of the districts identified in the SAoI, Zhambyl district has the greatest proportion of youths aged 0 to 15 years old at 34.6%, followed closely by Karasay district at 34.56%. Talgar district has the smallest proportion of youths at 30.45%, and the largest proportion of elderly population at 11.25%. Zhambyl district has the smallest working-age population by

[224] Department of Population Statistics. (2024). *The migration of the population of the Republic of Kazakhstan (January-September 2024)*. Retrieved 4 December 2024, from https://stat.gov.kz/en/industries/social-statistics/demography/publications/186251/

proportion of its population, though the group still forms over half of its population at 55.41%[225].

FIGURE 7-4: AGE DISTRIBUTION AT THE DISTRICT LEVEL

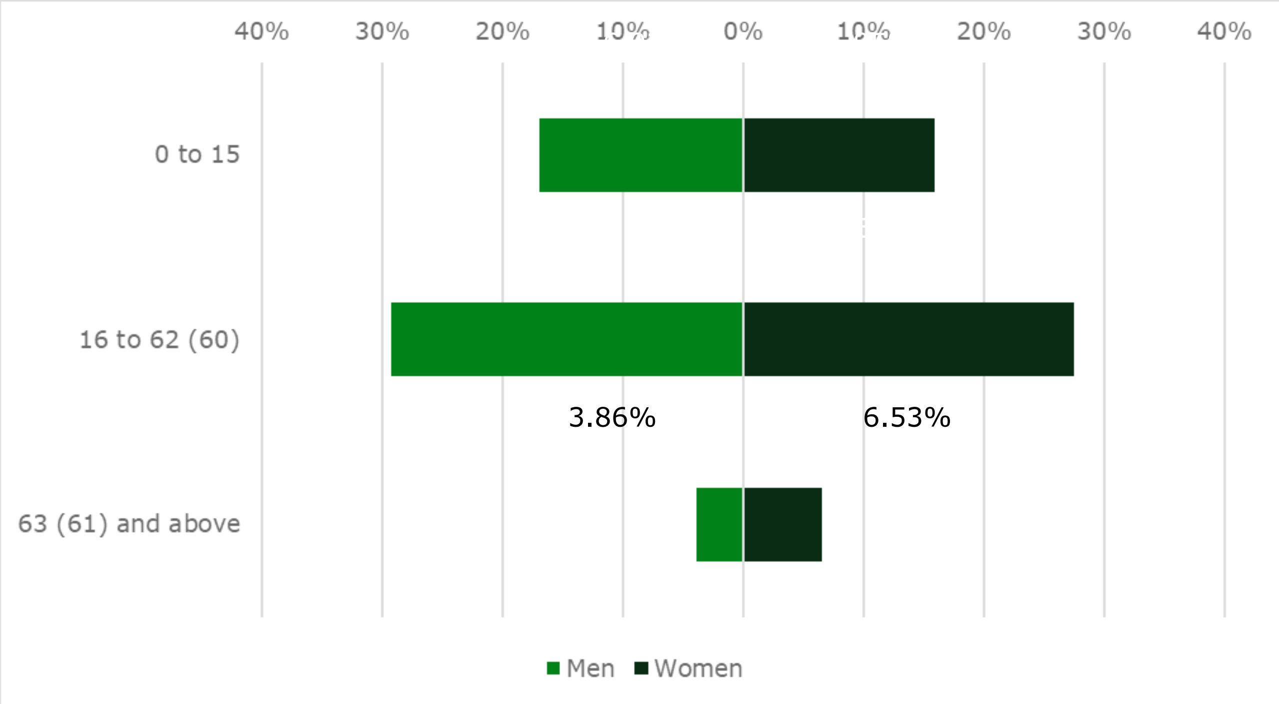


Note: The age categories provided are as such: 16 to 62 for men and 16 to 60 for women; 63 and above for men and 61 and above for women.

Figure 7-5 illustrates the population of Almaty region by gender and age using a population pyramid. The Almaty region has a large working population aged 16 to 62 (60 for women) [226]. Over half of the population (56.75%) of working age, while a significant percentage (32.87%) are infants or school-age between 0 and 15. Given the size disparity in the working-age group and the young dependents aged 0 to 15, there are potential implications for future workforce numbers and dependency ratios. There is a small proportion of elderly persons: that is men aged 63 and above and women aged 61 and above. While there is a clear decline in population for both genders in the elderly group, the greater decrease in population size for elderly men suggests that women have a greater life expectancy than men in the region, also contributing to the difference in the total female and male population. In the younger age cohorts, the number of men is greater than the number of women and this ratio changes only in the older age group.

[225] Department of Population Statistics. (2024). *The migration of the population of the Republic of Kazakhstan (January-September 2024)*. Retrieved 4 December 2024, from https://stat.gov.kz/en/industries/social-statistics/demography/publications/186251/
[226] Department of Population Statistics. (2024). *Population of the Republic of Kazakhstan by gender and type of locality (as of 1 October 2024)*. Retrieved 4 December 2024, from https://stat.gov.kz/en/industries/social-statistics/demography/publications/238285/

FIGURE 7-5: POPULATION PYRAMID OF ALMATY REGION



Note: The age categories provided are as such: 16 to 62 for men and 16 to 60 for women; 63 and above for men and 61 and above for women.

The demographic structure observed in the Almaty region is mirrored by the districts in the SAoI, namely in Alatau City, Karasay District, Zhambyl District, Iliy District and Talgar District. **Figure 7-6** describes the population pyramid in Alatau City and the four (4) districts as identified. The demographic structure of the SAoI is described below:

- **The working population forms the largest age group in each district. The percentage of working-age individuals in each district is as follows:**
  - Alatau City: 58.87%.
  - Karasay District: 56.65%
  - Zhambyl District: 55.41%
  - Iliy District: 56.67%
  - Talgar District: 54.29%
- **The elderly group forms the smallest segment of the population across all pyramids. The proportion in each district is as follows:**
  - Alatau City: 10.17%
  - Karasay District: 8.79%
  - Zhambyl District: 9.98%
  - Iliy District: 9.67%
  - Talgar District: 11.25%
- **There is a moderate proportion of youths (approximately 30-35%) in all districts**.
  - Alatau City: 31.26%
  - Karasay District: 34.56%

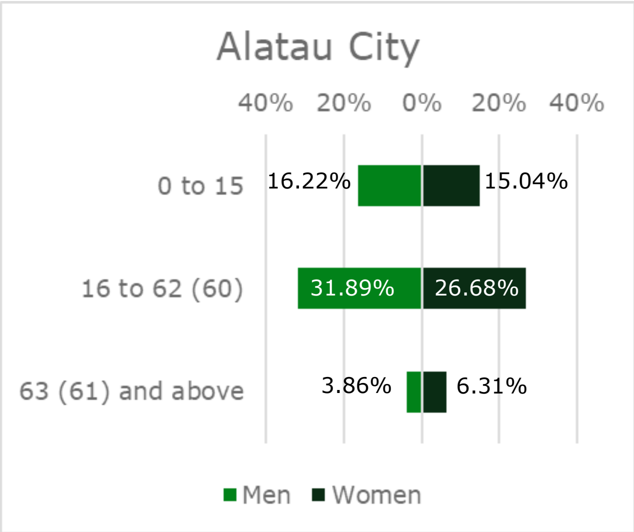
  - Zhambyl District: 34.60%
  - Iliy District: 33.66%
  - Talgar District: 30.45%
- **There is a larger proportion of women in the elderly category in all charts**.
- **There is a greater proportion of men across all populations in the young group of dependents aged between 0 and 15 and the working population with the exception of Talgar**. Talgar District has a greater proportion of women of working age than men of working age.

TABLE 7-5: GENDER RATIO ACROSS AGE GROUPS IN SAOI

District	Gender ratio (Male:Female) per age group		
	0-15	***16-62 (60)***	***63 (61) and above***
Alatau City	1.07	1.20	0.61
Karasay District	1.02	1.02	0.59
Zhambyl District	1.07	1.10	0.61
Iliy District	1.06	1.02	0.57
Talgar District	1.05	0.89	0.57

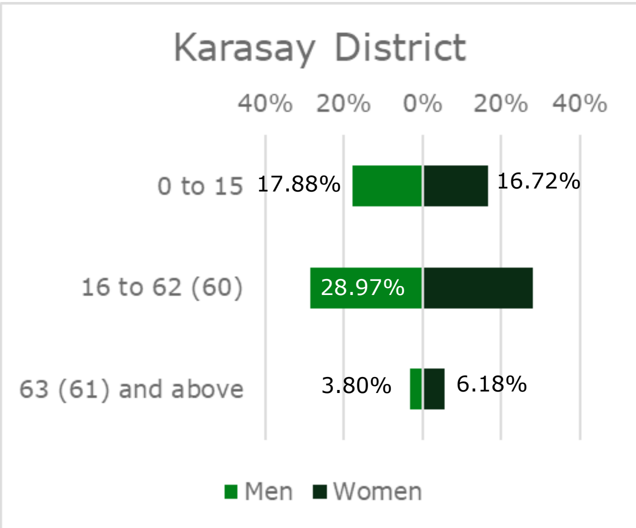
Note: The age categories provided are as such: 16 to 62 for men and 16 to 60 for women; 63 and above for men and 61 and above for women.
Source: Department of Population Statistics. (2024). *Population of the Republic of Kazakhstan by gender and type of locality (as of 1 October 2024)*. Retrieved 4 December 2024, from https://stat.gov.kz/en/industries/social-statistics/demography/publications/238285/

FIGURE 7-6: POPULATION PYRAMIDS AT THE DISTRICT LEVEL



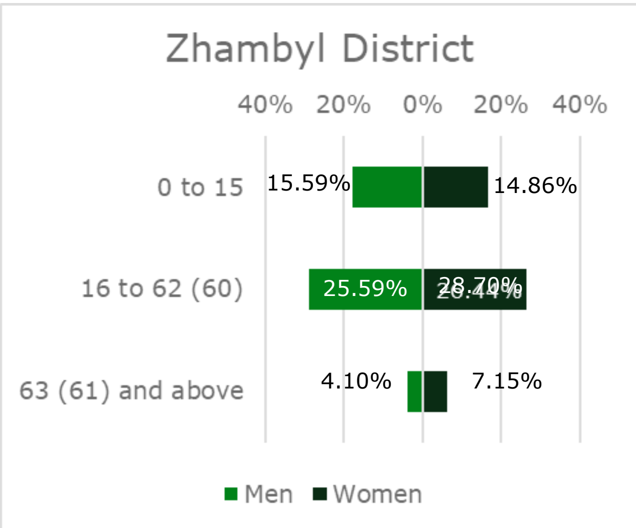
17.82% 16.74%

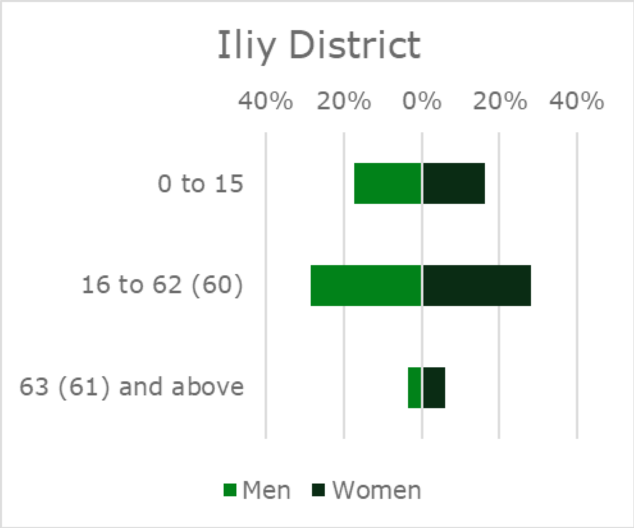
3.25% 5.54%

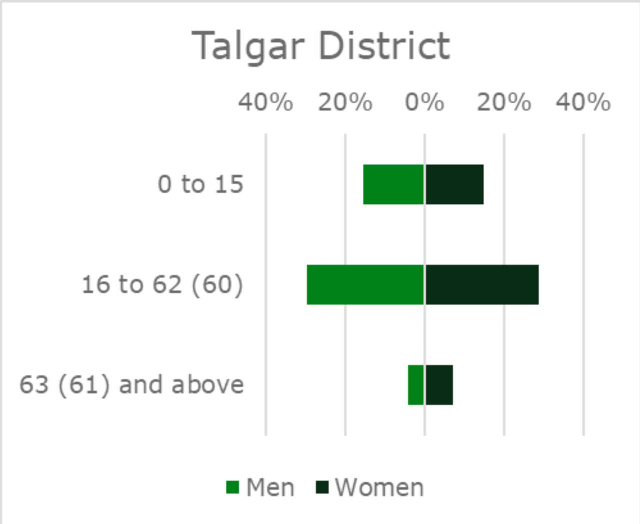


17.30% 16.36%

3.50% 6.17%







Note: The age categories provided are as such: 16 to 62 for men and 16 to 60 for women; 63 and above for men and 61 and above for women.
Source: Department of Population Statistics. (2024). *Population of the Republic of Kazakhstan by gender and type of locality (as of October 1, 2024)*. Retrieved December 4, 2024, from https://stat.gov.kz/en/industries/social-statistics/demography/publications/238285/

Gender Norms in the SAoI

This subsection presents some preliminary insights on the gender norms within the SAoI, based on the SSIs and FGDs conducted by ERM while on site. As the sampling method was not designed to be representative, further studies will need to be conducted to gain a more in-depth and nuanced understanding of the gendered dynamics within the SAoI.

- While women interviewed expressed that men and women have equal rights, the gender wage gap (women earning 78% of men's wages) reveals persistent systemic inequality.
- Women's roles are closely tied to family responsibilities, particularly after the age of 40, reinforcing traditional expectations that women will eventually prioritise family over personal or professional ambitions.
- Women's aspirations for daughters to secure good professions and 'adequate' husbands reflects the social value of careers for women, and a continued expectation of marriage as a component for social success.

- Influence of religion: stricter gender norms, especially in more religious Muslim families, may influence women's autonomy and opportunities.
- Increased opportunities for self-development, self-care and hobbies among women possibly indicates a shift toward recognising women's individuality and interests outside their family roles.
- Women interviewed are generally aware of the passing of the legislation: Law of the Republic of Kazakhstan No. 72-VIII of 15 April 2024, on Amendments to Kazakhstani Legislation Concerning Women's Rights and Safety of Children. However, it is unclear as to the extent to which social expectations, family dynamics and cultural influences will continue to enforce traditional views on gender, limiting systemic gender equality.

7.3.2.4 ETHNIC DISTRIBUTION

Historical Factors

The composition of Kazakhstan's ethnic groups is shaped by centuries of migrations and relocations, particularly during the Tsarist and Soviet eras, resulting in a diverse population of over 130 ethnic groups[227]. In the 1990s, Nursultan Nazarbaev's government pursued a nation building approach recognizing Kazakhs as people indigenous to the land, with a shared history of conflict and resistance during the Soviet era. In parallel, the state designated a Kazakhstani identity extended to all citizens to promote multi-ethnicity, recognising all other groups of various origins[228].

Ethnic Kazakhs, the titular nation, derive from the region's nomadic Turkic tribes, while significant Russian, Ukrainian, and German populations were established through settlement policies and deportations, particularly under Soviet rule. Uzbeks and Koreans also have historical ties to the region, with the latter being forcibly relocated in the 1930s. The interplay of cultural identities and demographic shifts, especially with the post-Soviet return of ethnic Kazakhs and the emigration of Russians and Germans, continues to influence Kazakhstan's national identity and interethnic relations today.

Ethnic Groups in Kazakhstan[229]

The Kazakhs form the largest ethnic group in Kazakhstan, with over 14.2 million people comprising nearly 70% of the population. Kazakhs have a strong presence in both urban (8.5 million) and rural (5.7 million) areas, indicating their wide distribution across the country.

Ethnic Russians form the second largest-ethnic group in Kazakhstan, with 2.98 million people making up approximately 15% of the population. Ethnic Uzbeks, Ukrainians and Uyghurs have much smaller populations, with each numbering below 1 million. **Figure 77** depicts the top 10 ethnic groups by population in Kazakhstan.

[227] Institute for European, Russian, and Eurasian Studies. (2023). *Policies on ethnic minorities in Kazakhstan*. Retrieved 2 December 2024, from https://ieres.elliott.gwu.edu/project/policies-on-ethnic-minorities-in-kazakhstan-where-are-
[228] Centre for East European and International Studies. (2020). *No unity about Kazakhstani identity*. Retrieved 2 December 2024, from https://www.zois-berlin.de/en/press/press-releases/no-unity-about-kazakhstani-identity
[229] The ethnic groups presented are aligned with the categories described in the national census of Kazakhstan.
Department of Population Statistics. (2024). *Population of the Republic of Kazakhstan by gender and type of locality (at the beginning of 2024)*. Retrieved 2 December 2024, from https://stat.gov.kz/en/industries/social-statistics/demography/publications/157662/

Rights of Kazakhs and Kazakhstanis

Under Kazakhstan's legal framework, per its Constitution, all ethnic groups are afforded equal rights and protections[230]. In practice, however, while the law espouses equality, there are nuances in how these rights are realized. Ethnic Kazakhs generally find more favourable opportunities, particularly in government positions, where a degree of "Kazakhization"[231] has taken place to promote the titular group's language and culture[232]. Non-Kazakh groups often benefit less from state support and may experience cultural and economic marginalization despite legal provisions[233]. While officially there are no differences in status, the lived experiences of different ethnicities reveal disparities in practice, particularly around employment and social integration[234].

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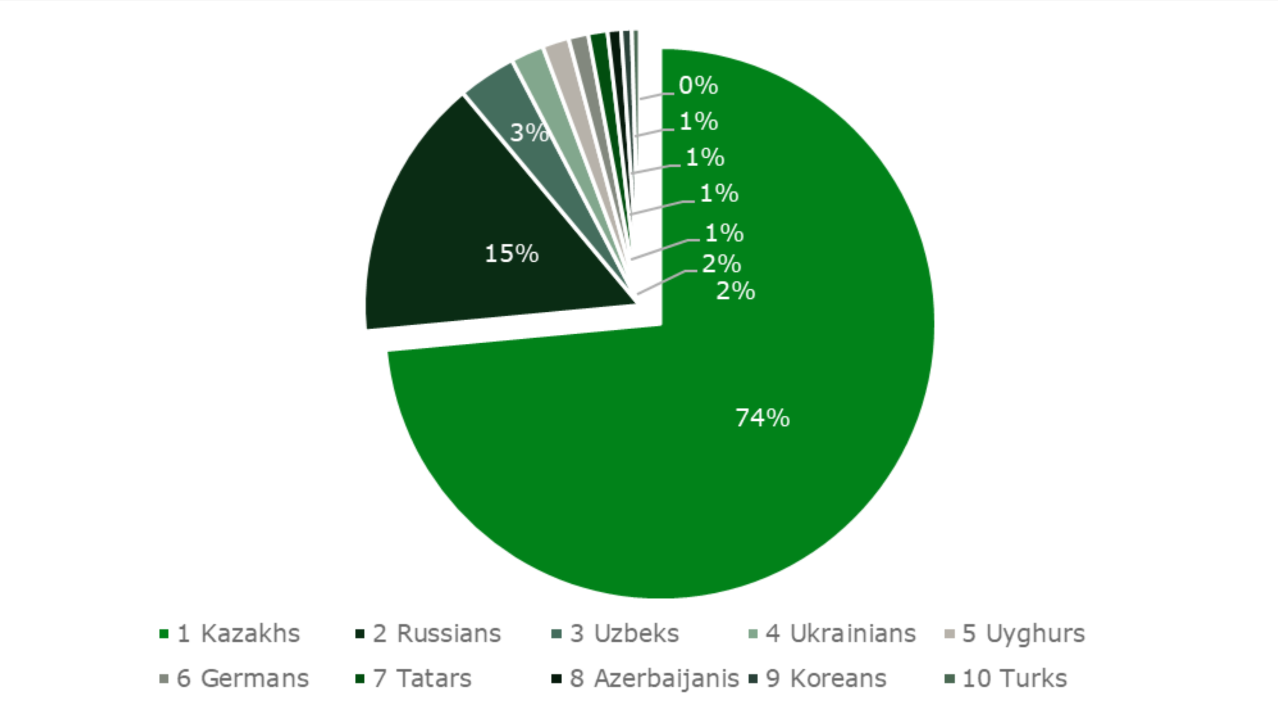
FIGURE 7-7: TOP 10 ETHNIC GROUPS BY POPULATION IN KAZAKHSTAN



Ethnic Groups in the Almaty Region

In the Almaty region, the same ten (10) ethnic groups predominate by proportion of the region's population. **Figure 7-7** and **Table 7-6** describes the proportion of the top ten ethnic

[230] Constitution of the Republic of Kazakhstan. (1995). Retrieved 2 December 2024, from https://www.akorda.kz/en/official_documents/constitution.
[231] Kazakhization refers to the promotion of Kazakh culture, language, and identity within the Republic of Kazakhstan. It includes the implementation of policies that favour ethnic Kazakhs in public sector employment and leadership positions, and the promotion of Kazakh symbols, heroes and historical figures in public memorials, monuments and educational curricula.
[232] Davenel, Y. (2012). Cultural mobilization in post-Soviet Kazakhstan: Views from the state and from non-titular nationalities compared. *Central Asian Survey, 31*(1), 17–29.
[233] Eschment, B., & Sutormina, T. (2020). Kazakh and/or Kazakhstani? The national identity of the Republic of Kazakhstan and its citizens. *ZOiS Report, 4*. Retrieved 2 December 2024, from https://www.zois-berlin.de/en/publications/kazakh-and/or-kazakhstani-the-national-identity-of-the-republic-of-kazakhstan-and-its-citizens
[234] Burkhanov, A. (2019). Multiculturalism and nation-building in Kazakhstan: Trends in media discourse, state policy, and popular perceptions. *The Muslim World, 110*(1), 24–39.

groups in the Almaty region and compares it to the proportion of the population of the respective ethnic groups more broadly in Kazakhstan.

TABLE 7-6: PROPORTION OF TOP TEN ETHNIC GROUPS BY POPULATION SIZE IN SAOI

No.	Ethnic Group	Proportion of Population in Almaty (%)	Proportion of Population in Kazakhstan (%)
1	Kazakh	35.49	70.98
2	Russian	7.45	14.89
3	Uzbek	1.65	3.30
4	Ukrainian	0.94	1.88
5	Uyghur	0.75	1.51
6	German	0.56	1.12
7	Tatar	0.55	1.09
8	Azerbaijani	0.38	0.76
9	Korean	0.30	0.60
10	Turk	0.22	0.45

Kazakhs make up 70.98% of Kazakhstan's population but only 35.49% in the Almaty Region. This reflects the greater ethnic diversity of the Almaty Region compared to the country as a whole. Kazakhs historically resided in rural areas due to their nomadic heritage and settlement patterns influenced by Soviet collectivisation.[235] Urbanisation in regions like Almaty diluted the Kazakh majority as industrialisation attracted ethnic minorities. The region's Urbanisation and economic opportunities attracted a mix of ethnic groups, leading to a lower concentration of Kazakhs compared to more rural regions[236].

Almaty, formerly the capital of Kazakhstan until Astana (now Nur-Sultan) was designated by President Nazarbayev in 1997, has long been a hub of economic, cultural, and social activity. The relocation of the capital to Astana shifted the focus of national development northward, which impacted Almaty. While it retained its status as a financial and cultural centre, the region experienced slower population and infrastructure growth compared to the capital. This redirection of development has likely influenced the ethnic diversity of the Almaty Region, as industrialization and migration patterns shifted to align with the new capital[237].

Russians, once concentrated in northern Kazakhstan and Soviet-era urban centres like Almaty, have seen a declining presence since independence in 1991 due to emigration

[235] Pianciola, N. (2019). Nomads and the state in Soviet Kazakhstan. *Asian History*. Retrieved 5 December 2024, from https://oxfordre.com/asianhistory/display/10.1093/acrefore/9780190277727.001.0001/acrefore-9780190277727-e-314
[236] Rowland, R. H. (1999). Urban population trends in Kazakhstan during the 1990s. *Post-Soviet Geography and Economics, 40*(7), 519–552.
[237] Arslan, M. (2014). The significance of shifting the capital of Kazakhstan from Almaty to Astana: An evaluation on the basis of geopolitical and demographic developments, *120*, 98–109.

prompted by cultural policy changes and reduced economic incentives[238]. While they have a significant presence in Almaty, their proportion is lower now.

For groups like Uzbeks, Ukrainians, Uyghurs, Germans, and Tatars, their proportions in Almaty (e.g., Uzbek 1.65%, Ukrainian 0.94%) are roughly half their national representation. This suggests that these groups, while present in Almaty, are more concentrated in specific regions across the country due to historical settlement patterns or economic migration. For instance, Uyghurs are concentrated in southeastern Kazakhstan due to historical ties and migrations from Xinjiang, China[239]. Similarly, the German population in the Almaty Region is related to Soviet-era forced relocations during World War II[240].

7.3.3 VULNERABLE GROUPS

Vulnerable groups among the Project-affected population were identified through ERM's site findings. ERM's site activities included data requests to Akimats facilitated by KTZ and the Client, Key Informant Interviews (KII), Focus Group Discussions (FGDs) and community consultations and semi-structured interviews (SSIs) for project affected entities (PAEs).

. In total, ERM conducted interviews with 46 households. Of these, six (6) households were identified as vulnerable: three (3) were women-headed households, with one (1) of them also including a person with disability (PWD) Additionally, two (2) other households had adult members of working age who were PWDs. Lastly, three (3) households consisted only of senior citizens aged over 60. ERM was unable to interview any low-income households (defined as annual household income of between 1 to 2 million tenge per year). There were no respondents within the sample frame who reported income in this range, and the land departments were unable to provide this information as they do not collect socioeconomic data.

Identified socially vulnerable groups within the SAoI are represented by the following categories of the population:

People with disabilities

Kazakhstan has approximately 730,500 people with disabilities (PWDs), accounting for around 4.0% of the population[241]. The government has ratified the UN Convention on the Rights of Persons with Disabilities, but significant gaps remain in implementing inclusive policies, especially in rural areas. Disabilities in Kazakhstan stem from various causes, including congenital disabilities, work-related injuries, and inadequate healthcare services.

The PWDs in Kazakhstan are supported by several state programs.

[238] Oskolkov, P. (2023). Sociopolitical dynamics of the Russians in Kazakhstan: Political participation and potential risks. Retrieved 6 December 2024, from https://besacentre.org/sociopolitical-dynamics-of-the-russians-in-kazakhstan/
[239] Minority Rights Group. (2023). Uyghurs in Kazakhstan. Retrieved 5 December 2024, from https://minorityrights.org/communities/uyghurs-2/#:~:text=Kazakhstan%27s%20historical%20Uyghur%20minority%20are,during%20the%20Sino%2DSoviet%20rift
[240] Minority Rights Group. (2023). Germans in Kazakhstan. Retrieved 5 December 2024, from https://minorityrights.org/communities/germans/
[241] United Nations Office of the High Commissioner for Human Rights. (2024). *Experts of the Committee on the Rights of Persons with Disabilities commend Kazakhstan for its commitment*. Retrieved 1 December 2024, from https://www.ohchr.org/en/news/2024/03/experts-committee-rights-persons-disabilities-commend-kazakhstan-its-commitment

- A 30% electoral quota for PWDs to ensure representation, leading to 71 deputies with disabilities to be elected in local representatives, and seven (7) to be elected in Parliament.
- The Coordinating Council on Persons with Disabilities was created as an independent institution to promote the rights of socially vulnerable categories of the population including PWDs.
- Free guaranteed legal aid for persons with disabilities in all social service centres.
- Accessibility considerations for public facilities and social infrastructure such as accessibility transport maps for the blind.
- Social assistance via disability pensions and allowances.
- The Social Code of Kazakhstan requires companies with at least 50 employees to establish a hiring quota reserved for PWDs of between 2% to 4%, though positions requiring heavy manual labour and risky working conditions are excluded.
- Prohibition of discrimination on the grounds of disability as enshrined in the Labour Code.
- Labour protections such as reduced working hours, prioritisation in hiring through wages subsidized by the state (Law on Employment), prioritisation in vocational training
- Provision of subsidies to employers to adapt workplace for PWDs.

However, challenges for PWDs remain. For instance, of the 419,000 PWDs of working age in Kazakhstan, only 27.4% are employed[242]. Reportedly, discrimination on the grounds of disability is still prevalent in the country[243].

Additionally, in rural areas such as in the Almaty region, accessibility to social infrastructure and a lack of transport options remain key challenges for PWDs[244].

Households with only post-retirement age members

Households in Kazakhstan composed solely of post-retirement age members face significant vulnerabilities. As of 1 May 2024, the average total pension in Kazakhstan was 132,399 tenge (USD $250), comprising a joint pension of 89,729 tenge (USD $170) and a basic pension of 42,670 tenge (USD $80). In the Almaty region, the average household income used for consumption is 84,150 tenge (USD $160) per month.

Post-retirement age members are likely elderly and may incur additional costs for medical reasons due to old age or illness. In rural parts of the Almaty region, limited access to healthcare services exacerbates the situation, as elderly individuals may struggle to obtain necessary medical care. Additionally, the migration of younger family members to urban centres or abroad in search of better opportunities often leaves elderly individuals isolated,

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[242] The Times of Central Asia. (2024). *Over 100,000 people with disabilities employed in Kazakhstan*. Retrieved 1 December 2024, from https://timesca.com/over-100000-people-with-disabilities-employed-in-kazakhstan/
[243] Committee on the Rights of Persons with Disabilities. (2019). *Information from civil society organisations: Kazakhstan* (INT/CRPD/ICO/KAZ/42630). Geneva: United Nations. Retrieved 2 December 2024, from https://tbinternet.ohchr.org/_layouts/15/treatybodyexternal/Download.aspx?symbolno=INT%2fCRPD%2fICO%2fKAZ%2f42630&Lang=en
[244] United Nations Development Programme. (2022). *Inclusiveness and accessibility on the path to a progressive society*. Retrieved 3 December 2024, from https://www.undp.org/kazakhstan/stories/inclusiveness-and-accessibility-path-progressive-society?utm

lacking both emotional and practical support. This combination of financial constraints, health challenges, and social isolation significantly diminishes the quality of life for elderly-only households in Kazakhstan.

Women-headed households

Women-headed households are considered vulnerable in Kazakhstan due to gender differences in access to economic resources, employment opportunities, and vulnerabilities during crises. For instance, the World Bank identified the following legal gaps which affect the life of a working woman in Kazakhstan[245]:

- Pay:
  - No law mandating equal remuneration for work of equal value.
  - Women are not able to work in jobs deemed dangerous in the same way as a man.
  - No provisions for women to work in an industrial job in the same way as a man.
- Pension
  - Different retirement age with full and partial benefits for men and women.
  - Different mandatory retirement age for men and women.
- Workplace
  - No legislation on sexual harassment .
  - No criminal penalties or civil remedies for sexual harassment.
- Entrepreneurship
  - No prohibition of access to credit based on gender discrimination.
- Parenthood
  - No paid leave available to fathers.

ERM found while on site that although women and men are both legally able to own land, women respondents were of the perspective that land is often owned and managed by men.

While the lower secondary school completion rate for girls (94.4%) is higher than that for boys (93.9%) and both genders have high literacy rates of over 99% in Kazakhstan, the labour force participation rate for women is lower than that for men. 63.2% of women of working age are economically active while 74.5% of males of working age are economically active.

Even as there is high female work participation, the nature of employment or work is strongly divided along gender lines. As mentioned in **Section 7.3.8,** within the Almaty region, sectors with a strong female presence include public health and social services (80.13%), education (71.52%), professional, scientific and technical activities (67.38%) among others. Sectors with a strong male presence include construction (94.32%), transport and storage (78.32%) and administrative and support activities (69.97%) among others. Respondents surveyed by ERM shared their perceptions that within the agricultural sector, women were rarely involved in livestock rearing or animal husbandry due to the physical strain involved in the sector.

Additionally, women shoulder a disproportionate amount of unpaid domestic and care work, which limits their ability to participate in the formal labour market and access income-generating opportunities. In Kazakhstan, women spend three (3) times as much time on

[245] World Bank. (2022). *Women, business and the law: Kazakhstan*. Retrieved 2 December 2024, from https://wbl.worldbank.org/content/dam/documents/wbl/2022/snapshots/Kazakhstan.pdf?utm

domestic and care work than men[246]. Women interviewed by ERM shared that they spend all their free time doing housework, while men serve a supporting role in helping with repairs and childcare.

Gender-based violence (GBV) remains an acute and pressing issue in Kazakhstan. In 2023, there were 99,026 reports made in relation to domestic violence, of which 37,186 were convicted by the court[247]. 17% of women in Kazakhstan have experienced physical and sexual violence from their partner, and these acts of violence have occurred repeatedly. 21% of women in Kazakhstan have experienced psychological violence from a partner in their lifetime. 24% of all women who have experienced physical, sexual or psychological violence have experienced all three forms of violence[248]. GBV is likely to be underreported as well, with 98% of the cases reported in Kazakhstan in 2017 involving rape[249].

In April 2024, amendments were introduced to Kazakhstan's Criminal Code, the Law on the Prevention of Domestic Violence, and the Law on Marriage and Family among others. The amendments involved:

- Criminalisation of violence against women and children;
- Criminalisation of battery and minor physical harm (previously decriminalised in 2017);
- Obligation of police to collect evidence in the case of alleged domestic abuse; mandate to investigate all cases heard via any avenue;
- Reconciliation is no longer an option for cases of repeated bodily harm;
- Life imprisonment for murder or rape of minors; and
- Criminalisation of sexual harassment and molestation of children under the age of 16 among others.

However, there are challenges in the implementation of these reforms. Despite the recent legal amendments, Kazakhstan still does not have a stand-alone definition for domestic violence, which limits its scope for addressing specific forms of abuse such as psychological violence, financial abuse and coercive control[250]. Additionally, there is inadequate infrastructure and support services for victims of GBV. This is especially so in rural areas, where there is a lack of shelters, counselling services and specialised healthcare facilities for survivors of GBV.

Efforts to combat GBV are hindered by deep-seated cultural norms that prioritise family cohesion over individual safety. The promotion of "traditional family values" in legislation risks downplaying violence within families and failing to address the specific needs of women in unregistered partnerships or extended family situations. The social stigma, fear of retaliation

[246] World Bank Gender Data Portal. (n.d.). *Kazakhstan*. Retrieved 5 December 2024, from https://genderdata.worldbank.org/en/economies/kazakhstan?utm

[247] Kazinform. (2024). *Domestic violence in Kazakhstan: What difficulties do the police face?* Retrieved 2 December 2024, from https://www.inform.kz/ru/semeyno-bitovoe-nasilie-v-kazahstane-skakimi-slozhnostyami-stalkivaetsya-politsiya

[248] UNICEF. (2024). *Astana students offer their solutions to combat gender-based violence*. Retrieved 2 December 2024, from https://www.unicef.org/kazakhstan/en/press-releases/astana-students-offer-their-solutions-combat-gender-based-violence

[249] UNFPA. (2020). *Rights of people with disabilities at risk of gender-based violence in Kazakhstan remains central during COVID-19*. Retrieved 2 December 2024, from https://kazakhstan.unfpa.org/en/news/rights-people-disabilities-risk-gender-based-violence-kazakhstan-remains-central-during-covid

[250] Claparede-Niemann, C. v. (2024). *Kazakhstan and Uzbekistan: New domestic violence laws and the protection of children*. Retrieved 3 December 2024, from https://thediplomat.com/2024/10/kazakhstan-and-uzbekistan-new-domestic-violence-laws-and-the-protection-of-children/

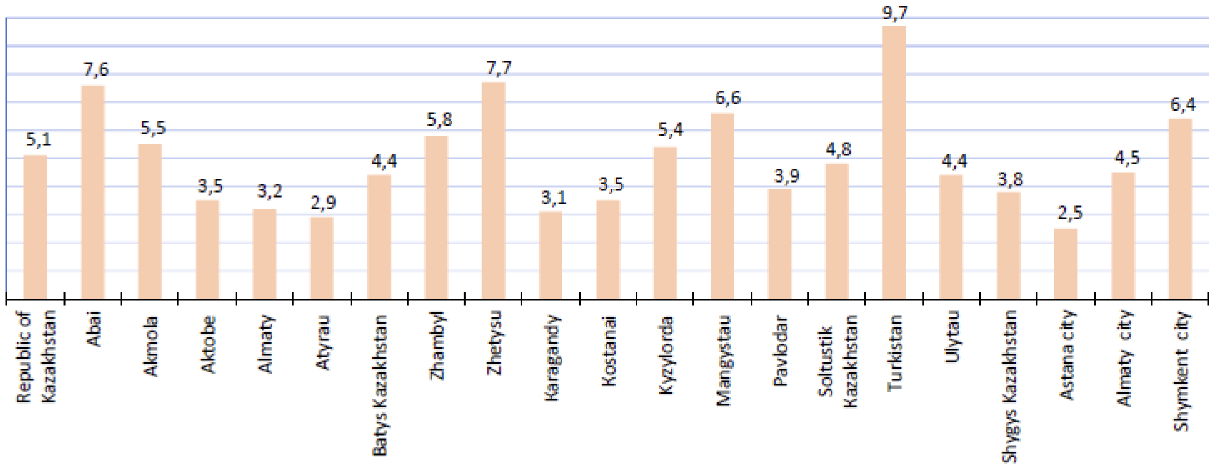
and limited faith in law enforcement also contributes to the underreporting of GBV in Kazakhstan[251].

Women interviewed by ERM in the SAoI shared their observations that some women are victims of domestic violence, and that they were aware of the new legislation aimed at protecting women. They described GBV as "problems in dysfunctional families", alcoholism, mentality and single parenthood. The issue of underreporting was attributed to victims being afraid to report the violence they suffer due to their "mentality" (taken to mean traditional attitudes).

Low-income households (defined as 1 to 2 million KZT in annual household income)

The minimum wage in Kazakhstan is 85,000 tengge (USD $160) per month, as of January 2024. This equates to approximately 1,020,000 tengge (USD $1,935) per year for someone under minimum wage. For the assessment of the social studies, and for the determination of livelihood restoration entitlements LRP, low-income households are considered those earning between 1 to 2 million tenge (USD $1,935 to USD $3,794) per annum.

FIGURE 7-8: PERCENTAGE OF POPULATION WITH INCOMES BELOW THE SUBSISTENCE MINIMUM BY REGION



Source: Department of Labour and Standard of Living Statistics. (2024). *The main indicators of income differentiation of the population of the Republic of Kazakhstan*. Retrieved 18 December 2024, from https://stat.gov.kz/en/industries/labour-and-income/stat-life/publications/212432/#:~:text=for%20the%20year-,According%20to%20the%20results%20of%20a%20sample%20survey%20of%20households,IIquarter%20of%202024%20was%205.1%25.

Within Kazakhstan, the regions with the highest percentage of its population with incomes below the subsistence minimum are Turkistan, Zhetysu, Abai, Mangystau and Shyment City. Almaty is amongst the regions with the lowest percentage of population with incomes below the subsistence minimum, and is ranked after Astana, Atryau and Karagandy.

Income and Economic Conditions of Interviewed Households

[251] Human Rights Watch. (2019). *Kazakhstan: Little help for domestic violence survivors*. Retrieved 1 December 2024, from https://www.hrw.org/news/2019/10/17/kazakhstan-little-help-domestic-violence-survivors

Based on both rounds of semi-structured interviews, no interviewed households identified as low-income. However, income per household member varies significantly across affected households. While all respondents reported household earnings above subsistence levels, 14 out of 17 households stated that there were times when it was difficult to meet basic needs[252].Of the 49 SSI respondents, the reported monthly household incomes varied widely, ranging from less than 100,000 KZT to greater than 500,000 KZT. While no household reported earning below the subsistence level (defined above as 1 to 2 million tenge per annum), some indicated financial strain due to ongoing expenses such as loans, medical costs, or seasonal fluctuations in income. The majority of households rely on salaries, pensions, business revenue, or agricultural income as their primary earnings. Some respondents indicated additional income sources such as seasonal agricultural work and small businesses.

Most respondents reported significant expenses on food, housing, utilities, healthcare, education, and taxes. In particular, medical expenses were frequently cited as a financial burden, especially among retirees and households with members requiring ongoing treatment[253]. While most households maintain financial self-sufficiency, several reported relying on loans or credit payments to cover household expenses. Others mentioned difficulties in saving due to high living costs.

7.3.4 INFRASTRUCTURE AND PUBLIC SERVICES

The infrastructure and public services available in the affected districts vary significantly between urban and rural contexts. Alatau City, being a newly designated urban area, has better access to healthcare, educational institutions, and transport infrastructure compared to rural districts such as Iliy, Zhambyl, and Talgar. However, according to locals in Alatau City, Alatau has only one hospital, which is not highly advanced. Complex cases must still be referred to larger hospitals in Almaty city. Similarly, public transport networks in Alatau are more structured, whereas rural residents rely more on personal vehicles or informal transport.

Transport infrastructure

There are four (4) primary modes of transport in the Almaty region, that is by land roads, by rail, by air and by water. The transport infrastructure available in the region is summarised in **Table 7-7**.

TABLE 7-7: TRANSPORT INFRASTRUCTURE IN ALMATY REGION

Mode of Transport	Length of Transport Route	Key Infrastructure
Land: motor vehicles	9,610km	• 244 bridges and 600 culverts • Taldykorgan bus station
Railway	2,143.4km	• 119 railway stations, 72 sidings and 12 overtaking stations
Air	Not applicable	• Almaty International Airport • Taldykorgan Airport

[252] This question was not included in the first round of SSIs conducted, and later added to better understand the presence of potentially vulnerable groups amongst the impacted households.
[253] This question was not included in the first round of SSIs conducted, and later added to better understand the presence of potentially vulnerable groups amongst the impacted households.

Mode of Transport	Length of Transport Route	Key Infrastructure
Water	2,030km	• Kapshagai Reservoir (110km) • Ili River (220km) • Lake Balkhash (1,700km)

- Source: KAZAKH INVEST. (2024). *Infrastructure*. Retrieved 5 December 2024, from https://almaty-region.invest.gov.kz/about/infrastructure/

From ERM's site observations, majority of the roads in the SAoI are paved and in good condition. Locals shared with ERM that the primary and preferred mode of transportation is private motor vehicles. The highways of national significance are divided into three (3) groups:

1. **M** – International highways.
2. **A** – Highways between main administrative, cultural and economic centres and neighbouring countries as well as roads significance.
3. **P** – other (regional) roads of national importance

Within the SAoI, the project footprint passes through: state-maintained roads part of the system of highways, including the sections of the highways cutting through Kazybek Bek Station, the intersection with the M36 Almaty-Astana highway (PK 226+33.14), the intersection with the P19 Karaoy-Sorbulak highway (PK 340+48.23), the intersection with the A3 Almaty-Ust-Kamenogorsk highway (PK 586+14.17), and at the intersection with the Almaty-Zhetygen highway (PK 645+77.85).

Furthermore, there are also other types of roads were observed in the SAoI:

4. **Secondary roads and tertiary roads:** paved roads within the existing villages of Kazybek Bek and Zhetygen station, and surrounding villages.
5. **Agriculture roads:** Unpaved (off-track) roads connected from secondary and tertiary roads.

ERM also found that there are guidelines on the types of vehicles allowed at different categories of the roads.

Healthcare Infrastructure

Kazakhstan's healthcare system is anchored in a Primary Healthcare (PHC)-centric model, a transition initiated post-independence to address the country's significant burden of noncommunicable diseases. In recent years, the country has prioritised the development of the PHC model, transitioning towards multidisciplinary, team-based care to address both medical and psychosocial health needs. Significant developments include:

- Introduction of mandatory health insurance, with the Social Health Insurance Fund becoming the purchaser of publicly paid health services in 2020. The aim was to reduce informal and out-of-pocket payments for medical bills.
- Adoption of The Concept of Health Infrastructure Development for 2024-2030.
    - Upgrade of 2,500 facilities and construction of 34 major projects, such as paediatric oncology and cardiac centres, and multidisciplinary hospitals.
    - Focus on rural and specialised care, including expanded emergency and paediatric services.

- Increase facilities accredited to Joint Commission International (JCI) standards and enhance equipment to 88% coverage.
- Reduce infrastructure wear to 30%, improve service quality, and enhance healthcare access across urban and rural areas.

In comparison to Kazakhstan's national average, the Almaty region lags behind in health infrastructure and resources as illustrated in **Table 7-8**.

TABLE 7-8: HEALTH INFRASTRUCTURE AND RESOURCES IN THE ALMATY REGION

Health Infrastructure/Resources	Kazakhstan	Almaty Region
Number of doctors per 10,000 persons	40.57	23.47
Number of secondary medical personnel per 10,000 persons	95.16	69.38
Number of hospitals per 10,000 persons	0.44	0.29
Number of hospital beds per 10,000 persons	53.08	38.55

The public hospitals within the SAoI and the services they provide are described in **Table 7-9**. Each district in the SAoI is served by at least one public hospital, which may also house primary health care service providers such as polyclinics and family medicine clinics. As Alatau City is a nascent city in development, its healthcare infrastructure is still under development. Other than the single hospital in Alatau City, current residents in Alatau City rely on the existing healthcare facilities available in neighbouring districts such as that of in the SAoI.

TABLE 7-9: PUBLIC HOSPITALS IN THE SAOI

Hospitals	Location	Services Provided
Karasay District Clinical Multidisciplinary Central Hospital	14 Zhangozina St, Kaskelen Town, Karasay District	Emergency care, various specialised medical treatments, surgical services, maternal and child health services, and rehabilitation programs.
Kargaly District Hospital	149 A. Beiseuova St, Kargaly settlement, Zhambyl District	Outpatient services, preventive care, and basic diagnostic services for the local population.
Zhambyl District Central Hospital	48 A Zhanakurylys St, Uzynagash Settlement, Zhambyl District	Emergency care, general medical treatments, maternal and child health services, and management of chronic conditions.
Regional Children's Clinical Hospital	10th Anniversary of Independence St. 35, Kuat Microdistrict, Iliy District	Specialisation in paediatric care; provides services in preventive care, diagnostics, treatment of acute and chronic illnesses, surgical interventions, and rehabilitation programs.
Iliy District Central Hospital	30 Titova St., Otegen Batyr, Iliy District	Emergency care, diagnostics, inpatient and outpatient treatments, maternal and child health services, and management of chronic diseases.
Boraldai Settlement District Hospital	1, Microdistrict Vodnik-1, Boraldai Settlement, Iliy District	General medical services, focusing on outpatient care, preventive services, and basic diagnostics; serves as a primary point of contact for residents in the area.

Hospitals	Location	Services Provided
Talgar District Central Hospital	5a Pavlova St, Talgar District	Emergency care, surgical procedures, maternal and child health services, and specialised treatments. The hospital's maternity department is equipped to handle complex birth cases and cares for premature newborns.
Source: Government of the Republic of Kazakhstan. (n.d.). *Polyclinics and primary healthcare facilities*. Retrieved December 2, 2024, from https://egov.kz/cms/en/articles/kont_polik		

Respondents interviewed by ERM shared that there are also private hospitals available within the SAoI, and that they were perceived to be of higher quality than state-owned hospitals. Additionally, some respondents raised concerns that there is an inadequate number of health facilities accessible to them, and that the facilities of the hospitals were deemed to be old. However, respondents also shared their perception that hospitals within Almaty City were of higher quality in general than that of the broader Almaty region.

While there are varied capacities and capabilities between the public health facilities in each district, hospitals local to the SAoI may refer complex cases to larger or more well-equipped hospitals in the Almaty City when needed.

The leading infectious diseases in Kazakhstan and the Almaty region are acute upper respiratory infections, measles and tuberculosis as described in **Table 7-10,** which refers to the year 2023.

TABLE 7-10: INCIDENCE RATE OF LEADING INFECTIOUS DISEASES

Infectious Disease	Kazakhstan	Almaty Region
Acute upper respiratory infections	20,982.18	17,577.57
Measles	149.40	183.94
Tuberculosis	30.67	33.52
Viral hepatitis	10.23	15.94
COVID-19	61.4	13.77
Syphilis	9.04	7.77
Scabies	4.25	3.95
Brucellosis	3.48	3.49
Flu	10.54	3.23
Pediculosis	10.51	0.79
Patriotitis epidemic	0.13	0.26
Meningococcal infection	0.21	-

Note: Incidence rate here refers to the number of cases per 100,000 people.
Source: Statistics of Health and Welfare. (2024). *The incidence rate of certain infectious diseases (January – December 2023)*. Retrieved 4 December 2024, from https://stat.gov.kz/en/industries/social-statistics/stat-medicine/spreadsheets/

Education infrastructure

Education in Kazakhstan is compulsory at the primary and secondary levels and is free of charge at public institutions from grade 1 to 11 (ages 6 to 17). There is a gross enrolment ratio of 100.52% at the primary school level, and gross enrolment ratio of 112% at the lower secondary school level[254,255].

The education system is highly centralised and overseen by the Ministry of Education and Science. The 'Comfortable School' initiative was launched in 2022 to modernize and expand educational infrastructure, to address longstanding issues such as overcrowded classrooms, emergency school facilities and a shortage of student places in secondary schools. The project aims to commission at least 740,000 new student places in cities and rural communities by 2026. By the end of 2025, 401 schools will be built and operational[256].

Within the Almaty Region, as part of the 'Comfortable School' initiative, 53 schools are set to begin student intake between 2024 and 2025, while another 26 are being commissioned to accommodate 600 to 1,500 students[257].

The Almaty region, as an educational hub, plays a pivotal role in the nation's academic landscape. Home to several renowned institutions, including Al-Farabi Kazakh National University and KIMEP University, Almaty contributes significantly to the country's higher education sector.

The key challenges in the education system are:

- **Urban-rural educational disparities:**

  Urban schools tend to have large student populations and face overcrowding, having to create multiple shifts to accommodate students. In comparison, rural schools tend to have small student populations and operate with fewer or poorer resources.

  Rural students score more poorly on the Unified National Test than urban students. Rural students score an average of 66.50 points while urban students average 76.16 points[258].

  In Alatau City, two (2) schools have been established, which has influenced some families to settle in the area due to access to educational facilities. This trend suggests that education availability plays a role in population growth in newly developed urban areas.

- **Inclusivity for students with disabilities:**

  Historically, children with disabilities were educated in separate "correctional" schools or specialised classes within mainstream schools, limiting their integration opportunities. Recent policies aim to increase the number of students with disabilities attending mainstream schools. However, implementation has been uneven, with many schools lacking the necessary resources, infrastructure, and trained staff to fully support inclusive

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[254] The gross enrollment ratio exceeds 100% as it exceeded the number of relevant school-age children recorded officially, indicating either due to early or late school entry and grade repetition.
[255] UNESCO. (2024). *Other policy relevant indicators: Gross enrolment ratio by level of education*. Retrieved 4 December 2024, from https://data.uis.unesco.org/index.aspx?queryid=3812&
[256] Canuto, A. (2024). *Investing in education for societal and economic growth: Kazakhstan's path to progress*. Retrieved 5 December 2024, from https://astanatimes.com/2024/02/investing-in-education-for-societal-and-economic-growth-kazakhstans-path-to-progress/
[257] Temirgaliyeva, A. (2024). *About 23,000 babies born in Almaty region since beginning of year*. Retrieved 5 December 2024, from https://en.inform.kz/news/kazakhstan-to-build-369-comfortable-schools-in-2024-2025-0e5b11/
[258] Rakisheva, A. (2022). *Bridging the urban-rural gaps in education in Kazakhstan*. Retrieved 5 December 2024, from https://eera-ecer.de/ecer-programmes/conference/27/contribution/52317

education[259]. Challenges to inclusivity has been attributed to the physical school infrastructure which remain inaccessible, a lack of specialised training for educators and the need for broad social acceptance of inclusive education[260].

- **Misalignment with labour market needs**

  While there is a significant number of university graduates annually in Kazakhstan, only about 20 to 25% of them find jobs in their respective fields. Fields such as economics, law and finance are oversaturated while industries employing from disciplines such as engineering, technical specialties and care work face labour shortages[261].

- **Educational Outcomes and Skill Level**

  Despite high enrolment rates, Kazakhstani students' performance in reading, mathematics, and science remains below OECD averages[262].

  Participation in adult education is low, with only 1.3% of adults achieving high proficiency in numeracy, ranking Kazakhstan 34th out of 37 countries surveyed[263].

  While Almaty city leads in digital literacy, with 86% proficiency among residents and over 10,000 individuals receiving digital skills training annually, at a national level, digital literacy remains poor. Approximately 38.1% of adults score at Level 1 in problem-solving in technology-rich environments, suggesting limited digital skills[264].

  In the Almaty region, a key skills gap identified lies in the tourism sector, particularly the lack of trained tourism professionals leading to an estimated loss in opportunity costs amounting to US $30 million[265].

7.3.5 LAND OWNERSHIP

The baseline analysis explores the land ownership and use patterns of areas affected by the Project, focusing on ownership structure, land use categories, and district-level distribution. It establishes the socio-economic significance of affected lands and sets the stage for assessing Project impacts on stakeholders.

7.3.5.1 LAND OWNERSHIP IN KAZAKHSTAN

During the Soviet era, all land was state-owned, and private land ownership was not allowed. After independence in 1991, Kazakhstan retained a system where the state remained the primary landowner, allowing private ownership only in specific cases.

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[259] Human Rights Watch. (2019). *On the margins: Education for children with disabilities in Kazakhstan*. Retrieved 6 December 2024, from https://www.hrw.org/report/2019/03/14/margins/education-children-disabilities-kazakhstan

[260] UNICEF. (2024). *Evidence on inclusive education in Kazakhstan based on a formative and a big data evaluation: A tale of two studies*. Retrieved 6 December 2024, from https://www.unicef.org/kazakhstan/en/reports/evidence-inclusive-education-kazakhstan-based-formative-and-big-data-evaluation

[261] Vasilevna, L. O., Altaevna, K. G., & Gazizollayevna, A. N. (2022). *Education and labour in Kazakhstan*. In *2022 International Conference on Humanities and Education*. Retrieved 6 December 2024, from https://webofproceedings.org/proceedings_series/ESSP/ICHE%202022/E19.pdf

[262] OECD. (2021). *OECD Skills Strategy Kazakhstan*. Retrieved 4 December 2024, from https://www.oecd-ilibrary.org/education/oecd-skills-strategy-kazakhstan_39629b47-en

[263] Education GPS, OECD. (2024). *Kazakhstan: Adult skills*. Retrieved 4 December 2024, from https://gpseducation.oecd.org/CountryProfile?primaryCountry=KAZ&treshold=5&topic=AS

[264] Education GPS, OECD. (2024). *Kazakhstan: Adult skills*. Retrieved 4 December 2024, from https://gpseducation.oecd.org/CountryProfile?primaryCountry=KAZ&treshold=5&topic=AS

[265] Almaty-Bishek Economic Corridor. (2019). *Improving education, skills, and employment in tourism*. Retrieved 4 December 2024, from https://www.adb.org/publications/education-skills-employment-tourism-abec

Land ownership in Kazakhstan is governed by the 2003 Land Code. Two main types of ownership are recognised: (i) state ownership of land for public use and (ii) private ownership by individuals and non-state entities. The types of land ownership in Kazakhstan are described in **Table 7-11**.

TABLE 7-11: TYPES OF LAND OWNERSHIP IN KAZAKHSTAN

Type of Ownership	Categories	Examples
Public	Defence and national security	Military facilities, defence infrastructure and land designated for protection of state border
	Specially protected natural areas	National parks, reserves
	Natural resources	Forest lands and water bodies
	Public infrastructure	Land for the construction and operation of public roads, highways, railway networks, airports, and other transportation infrastructure. Land for public utilities, including water channels, irrigation systems, and energy pipelines.
	Common use areas in settlements	Land used for public squares, parks, boulevards, playgrounds, and other community spaces
	Administrative and social facilities	Land allocated for government buildings, schools, hospitals, and cultural or social facilities such as libraries and museums
Private	Individual housing and cottage construction	Land for personal housing, dacha (suburban) construction, or private cottages.
	Agricultural use	Land for horticulture, afforestation, and private subsidiary farming.
	Commercial or industrial development	Land allocated for factories, warehouses, shops, and other commercial or industrial buildings.
	Maintenance of structures	Land for maintaining residential or non-residential buildings (e.g., offices, schools, factories).
	Horticulture and gardening	Land for personal or community gardening and small-scale cultivation of crops.

Temporary land use rights, detailed in **Table 7-12**, are granted for agricultural, commercial, or research/experimental purposes. These rights remain state-owned but allow users access for limited periods, ranging from 5 to 49 years. This framework creates a complex dynamic of state control and private or commercial access, influencing land utilisation in Project-affected areas.

TABLE 7-12: TEMPORARY LAND USE RIGHTS AND ELIGIBILITY CRITERIA

Type of Land Use Rights	Category	Purpose of Use	Eligible Parties
Short-term use	Agricultural	Farming, horticulture, grazing, and seasonal use for agricultural activities.	Citizens of Kazakhstan and non-state legal entities.

Type of Land Use Rights	Category	Purpose of Use	Eligible Parties
	Commercial/Industrial	Temporary use for construction or industrial projects	Citizens, non-state legal entities, and foreign entities.
	Research/Experimental	Scientific research or testing of agricultural methods	Citizens and legal entities.
Long-term use	Agricultural	Farming, long-term grazing, afforestation, and land improvement	Citizens of Kazakhstan and non-state legal entities.
	Commercial/Industrial	Long-term projects such as factories, mining, or infrastructure development	Citizens, non-state legal entities, and foreign entities.
	Public infrastructure	Use for constructing public roads, utilities, or other infrastructure	Citizens, non-state legal entities, and government bodies.

7.3.5.2 AGRICULTURAL ENTITIES AND ORGANISATIONS IN KAZAKHSTAN

Agriculture has been central to Kazakhstan's economy and society, with significant portions of the country's land dedicated to farming, grazing, and related activities. The evolution of land ownership and access rights, particularly through the reforms introduced after independence, created new opportunities and challenges for agricultural development. To ensure efficient land use and economic viability, the Land Code of Kazakhstan recognises various organisational forms for agricultural activities:

- **Peasant farms** are small-scale, family run farms which are non-commercial in nature. Peasant farms play a crucial role in Kazakhstan's agricultural system, especially in rural and family-centred farming contexts. Peasant farms benefit from a simpler taxation and registration process. In Southern regions, farms are typically small (3-6 hectares), focusing on subsistence farming. In Northern and Western regions, they are larger (50-20,000 hectares) and engage in grain production and other commercial activities[266].
- **Simple partnerships** refer to collabourative farming arrangements allowing partners to share labour and resources while retaining individual ownership of property. They enjoy lower taxation rates and a simpler registration process compared to commercial entities, and are ideal for seasonal collabouration in activities like planting and harvesting. Simple partnerships are predominantly found in grain-producing areas of the North; and are rare in the South (including the Almaty region), where peasant farms dominate[267].
- Other farm enterprises can be registered as **Joint Stock Companies, Limited Liability Partnerships and Private Companies**. Farm enterprises are often established from former state and collective farms and are supported by favourable government policies and preferential access to bank loans. Local LLPs tend to be favoured, owning large parcels of land in comparison to foreign LLPs.

[266] ARD Inc. (2005). *Assessment of the implementation of the interim provisions, Land Code: Final report*. USAID Kazakhstan.
[267] ARD Inc. (2005). *Assessment of the implementation of the interim provisions, Land Code: Final report*. USAID Kazakhstan.

7.3.5.3 LAND OWNERSHIP AND ACCESS RIGHTS OF LAND PLOTS IDENTIFIED FOR PROJECT ACQUISITION

According to information received by ERM, the land plots identified for Project acquisition include both state-owned land and privately-owned land. Of the state-owned land, some had been allocated to KTZ for the purpose of the Project, some were leased to individuals or commercial entities, and others were allocated to other state uses such as state departments and institutions

- **Table 7-13** shows that the majority of the impact will be borne by private landowners, as private land plots make up a high proportion of the affected land plots by number (58.80%) and area (68.95%).
- Leased land represents another area of concern, given the dual ownership dynamic where both owners and leaseholders could have dependence on the land. According to the District Akimats, all leaseholders affected are leasing land from the state (as opposed to leasing privately owned land).
- While the information on the land plots required for acquisition did not provide demographic information on the gender of landowners and users, ERM found on site that female-headed households are a likely vulnerable group in the SAoI and that some of them may be affected by the Project's land acquisition.
- Although men and women have equal, inheritance rights to land under Kazakh law and land ownership remains male-dominated. Women interviewed by ERM shared that men are more likely to own land than women.
- The Land Acquisition Department of the Iliy District confirmed that seven (7) of the affected landowners are female. Additionally, one of them may also be a PWD, suggesting that further considerations may need to be made for affected entities with compounding factors of vulnerability.
- The Zhambyl Land Acquisition Department also shared that six (6) women, including one who is also a senior citizen, were affected landowners.

TABLE 7-13: OWNERSHIP OF AFFECTED LAND PLOTS

Category	Total No. of Plots or Area of Plots (ha)	Proportion Across All Districts (%)
All Types of Land Ownership		
No. of Affected Plots	284	100.00%
Affected Area Within Land Plots (ha)	1056.43	100.00%
Private Ownership		
No. of Private Plots	167	58.80%
Affected Area Within Private Land Plots (ha)	728.41	68.95%
Leased Land Plots		

Category	Total No. of Plots or Area of Plots (ha)	Proportion Across All Districts (%)
No. of Leased Land Plots	52	18.31%
Affected Area Within Leased Land Plots (ha)	278.09	26.32%
State-Owned Plots Allocated to KTZ		
No. of State-Owned Plots Allocated to KTZ	38	13.38%
Affected Area Within State-Owned Plots Allocated to KTZ (ha)	42.5	4.02%
Other State-Owned Plots		
No. of Other State-Owned Plots	27	9.51%
Affected Area Within State-Owned Land Plots (ha)	7.43	0.70%

Table 7-14 builds on the insights from **Table 7-13** by breaking down ownership patterns across districts, revealing geographic variations critical to understanding local impacts. The variations in the size of land affected and the number of land plots affected in each district suggest differences in the impacted entities and affected stakeholders across districts.

- Iliy District emerges as the most affected district, accounting for the vast majority of both plots (49.30%) and area impacted (80.51%). This concentration of affected land suggests that Project impacts may disproportionately affect stakeholders in this district.
- Within Iliy District, private owners and lease holders are the primarily affected stakeholders.
- Talgar District accounts for 16.90% of the number of affected plots, but accounts for only 3.69% of the affected area. Similarly, Alatau City accounts for 17.25% of the number of affected plots but accounts for 7.93% of the affected area. Lands affected are predominantly private lands and leased lands, and land plots are assessed to be smaller and more fragmented (see **Table 7-33).**
- Over half (52.63%) of the affected state-owned plots allocated to KTZ are in Zhambyl District, and it represents 34.23% of the affected state-KTZ allocated plot area. This aligns with the district's large-scale agricultural leases and significant “other uses” land types. Acquisition of state-owned land plots designated for “other uses” may lead to physical and/or economic displacement, which will be discussed in further detail in **Section 7.3.7.**
- Karasay remains the least affected district in terms of the number of land plots impacted. The affected private plots in Karasay are among the largest on average (127.32 ha), suggesting that the district's affected land uses likely include larger agricultural or commercial holdings. However, Iliy District also has a similarly high average private plot size (124.11 ha), indicating that large-scale land use is not unique to Karasay. Details on the average land plot sizes are detailed in **Table 7-14.**

TABLE 7-14: LAND PLOTS AND AFFECTED AREA BY OWNERSHIP AND DISTRICT

	Alatau City		**Iliy District**		**Karasay District**		**Talgar District**		**Zhambyl District**	
	No./ha	Proportion (%)	No./ha	Proportion (%)	No./ha	Proportion (%)	No./ha	Proportion (%)	No./ha	Proportion (%)
Private Ownership										
No. of Plots	40	81.63%	75	53.57%	4	30.77%	41	85.42%	7	20.59%
Affected Area (ha)	66.84	79.85%	586.65	68.98%	14.98	37.88%	34.97	89.76%	24.97	57.13%
Leased Land Plots										
No. of Plots	9	18.37%	32	22.86%	2	15.38%	5	10.42%	4	11.76%
Affected Area (ha)	16.87	20.15%	239.30	28.14%	14.33	36.23%	3.4	8.73%	4.19	9.59%
State-Owned Plots Allocated to KTZ										
No. of Plots	0	0.00%	13	9.29%	5	38.46%	0	0.00%	20	58.82%
Affected Area (ha)	0	0.00%	17.72	2.08%	10.24	25.89%	0	0.00%	14.55	33.29%
Other State-Owned Plots										
No. of Plots	0	0.00%	20	14.29%	2	15.38%	2	4.17%	3	8.82%
Affected Area (ha)	0	0.00%	6.84	0.80%	0.00	0.00%	0.59	1.51%	0.00	0.00%

7.3.5.4 MARKET VALUE OF PROJECT-AFFECTED LANDS

This subsection presents the market value of project-affected lands by considering:

- The average size of an affected land plot in each district by type of ownership; and
- Indicative data on the market value of affected land plots gathered through KIIs and SSIs conducted by ERM while on site.

Despite having the lowest number of affected private plots (4), Karasay District has the largest average private plot size (127.32 hectares), followed closely by Iliy District (124.11 hectares). Zhambyl District (43.66 hectares) has the next highest average private plot size. This suggests that private land in these districts is likely more rural, where private land plots are inherently larger due to their location. However, commercial land use—such as agriculture, logistics, or industrial operations—may also contribute to these large plot sizes, potentially due to land consolidation.

Landowners interviewed by ERM expressed that those engaged in livestock and agriculture may not register their land use as commercial, instead opting to classify their holdings as subsidiary or family farms (peasant farms) to access specific benefits.

Leased land in Zhambyl District stands out, with an average size of 248.70 hectares — far exceeding that of other districts. This is likely indicative of large-scale agricultural or commercial leases in the district. This aligns with interview data collected by ERM while on site: land in Zhambyl is primarily used for farming and not residential purposes, with all affected landowners living outside the district. These owners are engaged in agriculture in a particular settlement but reside elsewhere, indicating an economic dependency on the land but limited residence-linked associations or networks.

Similarly, the relatively large average size of private plots in Karasay can be attributed to commercial operations. The Karasay Land Acquisition Department noted the presence of multinational corporations (MNCs) like beverage bottling units and logistics hubs, suggesting that some larger plots may have shifted from agricultural to industrial use.

Further analysis on the land use of the Project-affected plots within each district is further described in **Section 7.3.6.**

Larger plots, especially those in Zhambyl and Karasay districts, are likely to have higher market values due to their potential for large-scale agricultural or industrial use. Land reconfiguration requests were noted in Karasay, highlighting the importance of addressing landowner needs particularly for industrial plots.

The average plot sizes in Talgar (4.08 ha across all types) are the smallest among the districts, suggesting fragmented and localized land use, likely dominated by smaller-scale agricultural activities or residential land. The interviews conducted on site revealed:

- Some landowners in Talgar rent out their land for cultivation to avoid the risk of the government reclaiming unused land.
- Fragmented land often corresponds to marginal or lower-quality agricultural plots

These differences in plot size and use align with market valuation challenges highlighted in interviews, where factors like irrigation, location, and productivity significantly influence compensation amounts.

TABLE 7-15: AVERAGE SIZE OF LAND PLOT PER DISTRICT AND OWNERSHIP

Average Plot Size	Alatau City	Iliy District	Karasay District	Talgar District	Zhambyl District
All Affected Plots (ha)	7.09	125.86	43.26	4.08	51.51
Private Plots (ha)	6.19	124.11	127.32	3.88	43.66
Leased Land Plots (ha)	11.07	164.63	19.06	3.40	248.70
State-Owned Plots Allocated to KTZ (ha)	0.00	4.45	2.95	0.00	0.84
Other State-Owned Plots (ha)	0.00	149.34	0.12	9.86	144.63

Interview data on average agricultural land prices (500,000 tengge or USD $950 per 100m^2) and the high demand for irrigated land suggest:

- Compensation amounts in districts like Karasay and Zhambyl may be relatively higher due to higher-value plots.
- Fragmented land in the districts, especially in Talgar, means reduced market value.
- Additional factors such as location, irrigation, and productivity as appraised by the valuator will further affect the valuation of the land parcels.

7.3.6 LAND USE OF PROJECT-AFFECTED PLOTS

7.3.6.1 PRIVATELY OWNED LAND PLOTS

Table 7-16 describes the various land uses on privately-owned plots as formally registered with the District Akimats, in the information made available to ERM.

Private land plots are primarily used for peasant farming, which primarily refers to individuals or households engaging in small-scale, non-commercial farming of crops or livestock.

TABLE 7-16: LAND USE ON PRIVATE LAND PLOTS ACROSS ALL DISTRICTS

Land Use	No. of Plots	Proportion of No. of Plots (%)	Affected Area (ha)	Proportion of Affected Private Lands (%)
Peasant Farming	145	86.83%	533.67	72.65%
Commercial Agriculture	8	4.79%	195.03	26.55%
Other	14	8.38%	5.93	0.81%
Total	**167**	**100%**	**705.06**	**100%**

The majority of private land plots (86.83%) are used for peasant farming, accounting for 145 plots and covering 533.67 hectares (72.65% of the affected private land area). This reflects the prevalence of small-scale, non-commercial agricultural activities, likely focused on subsistence farming or family-run operations.

Although only 8 plots (4.79%) are designated for commercial agriculture, these plots occupy a disproportionate share of the affected private land area (26.55%). This suggests that commercial agricultural plots are much larger in size compared to peasant farms, highlighting their potential economic significance.

While there has been no information provided by District Akimats on the "Other" land uses, this category is likely to include a mix of marginal or less-defined land uses, such as unused plots, residential plots, or other purposes not directly tied to agriculture. Further assessment on the impacts of the Project on economic and potential physical displacement of the landowners and users are described in **Section 7.6.1** and the Livelihood Restoration Plan.

Table 7-17 describes the **district-level variations in land use** for the affected privately-owned land plots:

- There are only eight (8) privately-owned commercial land plots affected, with the vast majority of them (five (5) out of eight (8)) being concentrated in Iliy District.
- Commercial plots are significantly larger and likely more economically significant in comparison to peasant farms: the five (5) plots in Iliy District occupy 31.22% of the affected area in the district.
- As mentioned, the small average plot size in Talgar District indicates fragmented, small-scale operations. Small plot sizes are typically associated with subsistence farming as they are not sufficiently large enough to support commercial activities. Farmers may grow crops or rear livestock primarily for household consumption rather than for sale.
- Commercial agricultural plots in Iliy District are significantly larger than peasant farms and occupy 31.22% of the affected private land in the district. This indicates that while commercial agriculture is not widespread, it plays a notable role in land use within Iliy District.
- Peasant farming in Iliy District is likely to be characterised by a mix of small, family-run plots and larger commercial plots, with some relatively large plots (totalling 402.57 hectares) compared to other districts.
- The category of "other" uses is predominantly found in Zhambyl District. Further information is needed to assess the type of land use in this category, and how it relates to other land patterns in the district.

TABLE 7-17: LAND USE ON PRIVATE LAND PLOTS BY DISTRICT

	Alatau City		**Iliy District**		**Karasay District**		**Talgar District**		**Zhambyl District**	
	No./ hectares	Proportion (%)	No./ hectares	Proportion (%)	No./ hectares	Proportion (%)	No./ hectares	Proportion (%)	No./ hectares	Proportion (%)
Commercial Agriculture										
No. of Plots	2	5.00%	5	6.67%	1	25.00%	0	0	0	0
Affected Area (ha)	9.04	12.38%	183.18	31.22%	2.81	18.77%	0	0	0	0
Peasant farming										
No. of Plots	35	87.50%	65	86.67%	2	50.00%	41	100%	2	28.57%
Affected Area (ha)	63.69	87.19%	402.57	68.62%	10.70	71.47%	34.97	100%	21.73	87.04%
Other										
No. of Plots	3	7.50%	5	6.67%	1	25.00%	0	0	5	71.43%
Affected Area (ha)	0.32	0.43%	0.91	0.16%	1.46	9.77%	0	0	3.24	12.96%

7.3.6.2 LEASED LAND PLOTS

Leased land plots, though fewer in number than private plots, occupy a significant portion of the affected area as described in earlier sections of the baseline. **Table 7-18** highlights that the leased land plots is dominated by commercial agriculture and leased farming.

Commercial agriculture accounts for a smaller proportion of the number of plots, but the majority of the affected leased land area at 58.27%. This aligns with the need for larger land parcels for commercial operations.

Conversely, leased farming represents 63.46% of the leased plots (33 plots) but occupies a smaller proportion of the total leased land area (113.41 hectares, 40.78%). This suggests that leased farming in the Project area is generally small-scale and sustenance-oriented, catering to household needs rather than large-scale commercial production. The relatively large number of plots affected suggests that there may be a large number of users who are affected, particularly if there is more than one user per leased plot of land.

The category of "other" uses is minimal, representing only nine (9) plots (17.31%) and 0.95% of the affected leased land area (2.63 hectares). These plots are likely to include marginal or less-defined land uses, such as idle land or non-agricultural purposes.

TABLE 7-18: LAND USE ON LEASED LAND PLOTS ACROSS ALL DISTRICTS

Land Use	No. of Plots	Proportion of No. of Plots (%)	Affected Area (hectares)	Proportion of Affected Leased Lands (%)
Commercial Agriculture	10	19.23%	162.05	58.27%
Leased Farming	33	63.46%	113.41	40.78%
Other	9	17.31%	2.63	0.95%
Total	**52**	**100.00%**	**278.09**	**100.00%**

District-level variations (**Table 7-19**) highlight key differences in leased land use across the Project area.

- Commercial agriculture is concentrated exclusively in Iliy District, which holds all 10 plots and accounts for 67.72% of the affected leased land area in the district. The absence of commercial agriculture in other districts suggests that Iliy may have better infrastructure, land suitability, or accessibility for large-scale farming.
- Leased farming is more evenly distributed across districts:
  - Alatau City: All leased land in this district is used for leased farming, covering 16.87 hectares.
  - Iliy District: The largest portion of leased farming is here, covering 75.56 hectares (31.57%).
  - Karasay District: Has only 2 plots but a high average plot size (14.33 hectares), suggesting more organised or commercialized leased farming.
  - Talgar District and Zhambyl District also have leased farming, but on a smaller scale.

- The “Other” category is present in Iliy (8 plots) and Zhambyl (1 plot), with a minimal share of the affected area (1.69 hectares and 0.94 hectares, respectively). This suggests that non-agricultural leased land use is limited.

TABLE 7-19: LAND USE ON LEASED LAND PLOTS BY DISTRICT

	Alatau City		**Iliy District**		**Karasay District**		**Talgar District**		**Zhambyl District**	
	No./ha	Proportion (%)	No./ha	Proportion (%)	No./ha	Proportion (%)	No./ha	Proportion (%)	No./ha	Proportion (%)
Commercial Agriculture										
No. of Plots	0	0.00%	10	31.25%	0	0.00	0	0.00	0	0.00
Affected Area (ha)	0	0.00%	162.05	67.72%	0.00	0.00	0.00	0.00	0.00	0.00
Leased farming										
No. of Plots	9	100.00%	14	43.75%	2	100.00%	5	100.00%	3	75.00%
Affected Area (ha)	16.87	100.00%	75.56	31.57%	14.33	100.00%	3.41	100.00%	3.25	77.59%
Other										
No. of Plots	0	0.00%	8	25.00%	0	0.00	0	0.00	1	25.00%
Affected Area (ha)	0	0.00%	1.69	0.71%	0.00	0.00	0.00	0.00	0.94	22.41%

7.3.6.3 STATE-OWNED LAND

State-owned lands are divided into two main categories: i) Existing Lands Allocated to KTZ and ii) Other Existing State Use Lands. While they constitute a smaller proportion of the total affected area compared to private and leased lands, they play a critical role in facilitating infrastructure and public services (**Table 7-20**).

State lands already allocated to KTZ are likely tied to current railway operations, reinforcing the essential role of infrastructure in connecting these districts. The reliance on these lands signal minimal additional displacement of state functions, as their existing designation aligns with the project’s purpose. However, implications for surrounding communities and other state land uses remain.

All state-owned land were classified as "Other" land use. There is no additional information on the actual formal and informal land use of state-owned land provided to ERM at the time of writing. According to information received by ERM, the required state-owned land already allocated to KTZ was likely from KTZ’s rail operations outside of this Project, as reflected in the large proportion of the affected area. They could also have been recently transferred to KTZ’s ownership for the purpose of the Project. The smaller land area of Other Existing State Use Lands (7.43 hectares) means that impacts on public services or utilities are likely limited.

TABLE 7-20: LAND USE OF STATE-OWNED LAND ACROSS ALL DISTRICTS

Land Use	No. of Plots	Proportion of No. of Plots (%)	Affected Area (hectares)	Proportion of Affected Leased Lands (%)
Existing Lands Allocated to KTZ	38	58.46%	42.50	85.12%
Other Existing State Use Land	27	41.54%	7.43	14.88%
Total	**65**	**100.00%**	**49.94**	**100.00%**

Table 7-21 provides insights into the distribution of state-owned lands across districts, highlighting regional differences in usage patterns.

- The dominance of KTZ-allocated state land in Zhambyl District (20 plots, 86.96% of state-owned plots, 14.55 hectares) reflects the Project’s integration with existing rail infrastructure. This suggests minimal conflict with alternative public uses.
- The reliance on Other Existing State Use Lands in the other three districts suggests a need to further understand the land uses in this category.

TABLE 7-21: LAND USE OF STATE-OWNED LAND BY DISTRICT

	Iliy District		**Karasay District**		**Talgar District**		**Zhambyl District**	
	No./hectares	Proportion (%)	No./hectares	Proportion (%)	No./hectares	Proportion (%)	No./hectares	Proportion (%)
Existing Lands Allocated to KTZ								
No. of Plots	13	39.39%	5	71.43%	0	0.00	20	86.96%
Affected Area (ha)	17.72	72.14%	10.24	100.00%	0.00	0.00	14.55	99.97%

	Iliy District		Karasay District		Talgar District		Zhambyl District	
Other Existing State Use Land								
No. of Plots	20	60.61%	2	28.57%	2	100.00%	3	13.04%
Affected Area (ha)	6.84	27.86%	0.00	0.00%	0.5852	100.00%	0.00	0.03%
Note: No state-owned land was identified in Alatau City in the information made available to ERM at the time of writing.								

7.3.7 EXTENT OF PROJECT LAND ACQUISITION

Information received by ERM suggests that the land required for the Project includes:

- Permanent acquisition of 274 plots of land described in Annex 5 of the IFC Gaps Analysis Report and 10 plots of land around Zhetygen station described in the information provided by KTZ which comprises of the Project footprint and its associated RoW amounting to approximately 1056 hectares; Temporary acquisition of 14 quarries from state-owned land amounting to approximately 181 hectares.
- Permanent acquisition of small parcels of land for transmission towers supporting a 1.961km OHTL of 220kV connecting the greenfield substation at Zhana Arna station to the existing substation PS Alma-500 (located outside the project boundary and not belonging to the project). Approximately 500m of the 1.961km stretch of land is within the Project's RoW. The land to be acquired, according to KTZ, will be 1m x 1m for each transmission tower outside of the RoW, with an estimated 17-19 towers required. As of 20 January 2025, the land acquisition had not yet begun.

The construction of a 73km 10kV transmission line underground along the alignment and within the RoW. The transmission line will be positioned about 10-15m left or right of the alignment, depending on the situation. In response to inquiries regarding access roads and potential additional land requirements, KTZ did not provide any relevant information. However, one respondent interviewed by ERM during a SSI whose land was partially impacted shared that construction workers had asked for permission to drive along their lands for construction purposes. It is likely that there were temporary land requirements for the purpose of construction access roads, which were based on agreements between contractors and/or subcontractors and private landowners. Building on the baseline analysis of land ownership and use, this section examines the extent of land acquisition for private and leased lands, which together account for the majority of the affected area and directly influence risks of economic and physical displacement. By analysing whether plots are fully or partially acquired and assessing potential fragmentation, this section provides insights into the typology, nature and scale of impacts on project-affected entities.

7.3.7.1 EXTENT OF ACQUISITION OF PRIVATE LANDS

Majority of private plots affected by the Project (136 plots, or 81.44%) are partially acquired, whereas 28 plots (16.77%) are entirely acquired (Table 7.22).

Partial acquisition is concentrated in peasant farming plots, which make up 118 of the 136 plots (86.76%), followed by "Other" land use at 10 plots (7.35%), and commercial agriculture at 8 plots (5.88%). This reflects a trend where small-scale, subsistence farmers are disproportionately impacted by the partial loss of their land, leading to significant economic displacement risks. Many peasant farmers rely on small plots for their livelihood, and the loss of even a portion of their land can impact their economic stability.

Entire acquisition is also concentrated in peasant farming, with 24 plots (85.71%) impacted. However, the lack of commercial agricultural plots in this category suggests that commercial farming operations may have been strategically preserved to avoid economic disruption. .

The "other" land use category accounts for four (4) plots (14.29%), which were entirely acquired and 10 plots (7.35%) which were partially acquired. The “Other” category may represent non-agricultural uses or mixed-use plots with marginal economic significance.

TABLE 7-22: EXTENT OF ACQUISITION OF PRIVATE LANDS ACROSS ALL DISTRICTS

Category		**Proportion of Land Impacted (%)**											**Total**
		>0-10%	**>10-20%**	**>20-30%**	**>30-40%**	**>40-50%**	**>50-60%**	**>60-70%**	**>70-80%**	**>80-90%**	**>90-100%**	**Data Gap**	
Peasant Farming	No. of Plots	52	22	16	8	9	2	3	3	3	24	3	145
	Proportion of No. of Plots (%)	36%	15%	11%	6%	6%	1%	2%	2%	2%	17%	2%	100%
Commercial Agriculture	No. of Plots	2	1	2	1	2	0	0	0	0	0	NA	8
	Proportion of No. of Plots (%)	25%	13%	25%	13%	25%	0%	0%	0%	0%	0%	NA	100%
Other	No. of Plots	6	3	1	0	0	0	0	0	0	4	NA	14
	Proportion of No. of Plots (%)	43%	21%	7%	0%	0%	0%	0%	0%	0%	29%	NA	100%

Table 7-23 describes the distribution of private land acquisition at a district level.

Iliy District has the largest share of partially acquired plots (57 plots), including commercial agriculture (5 plots, 8.77%), peasant farming (47 plots, 82.46%) and other land use (5 plots, 8.77%). This aligns with Iliy's role as a hub for various agricultural activities, as noted earlier.

Iliy District also accounts for all 27 entirely acquired plots, primarily peasant farming (23 plots, 85.19%), with 4 plots (14.81%) categorized under "Other" land use. No commercial agricultural plots were entirely acquired. Additionally, a portion of the lands to be procured for the Project's land requirement under the Iliy District's administration is more urban in nature, particularly the Zhetygen village which was announced to form part of Alatau City in 2024. Hence it is likely that a portion of the lands affected in Iliy District are smaller in size, and more likely to be unviable after acquisition, leading to those land plots being entirely acquired.

Karasay is the only district where all affected plots were partially acquired (100%), and no plots were entirely acquired (0%). This may be due to the larger average plot size of private plots in Karasay, which is 127.32 hectares (the largest among all districts). Additionally, as Karasay is a rapidly developing industrial and logistics hub, the alignment may have been strategically designed and positioned to avoid disruptions to the district's development. Industrial and commercial lands are likely to be also more valuable, making full acquisition less feasible.

Talgar and Zhambyl both have a mix of partially and entirely acquired plots, unlike Karasay (which had only partial acquisitions) and Iliy (which had a high concentration of entirely acquired plots). Most of the private land plots in Talgar (46 or 93.89%) are partially acquired, with only three (3) land plots being fully acquired. the size of land plots in Talgar being very small and fragmented, dominated by small-scale farming. If a plot is already small and fragmented, acquiring only a portion of it might render the remaining land unusable for farming or other purposes. As a result, such plots are more likely to be entirely acquired rather than partially, to avoid leaving land that cannot be effectively utilised. That most of the land plots in Talgar are partially acquired rather than fully acquired may be due to the optimisation of the alignment to minimise disruptions to livelihoods in Talgar.

Based on the key informant interview with the Talgar Land Department, the possibility that entire land plots were acquired rather than partially is supported by several factors inherent to the land acquisition process and the characteristics of the affected plots in Talgar:

- The Land Department has a provision to take over and compensate for the entirety of a plot if the leftover portion becomes unviable after partial acquisition. While the informant was not aware of specific cases under this Project, the nature of small, fragmented plots in Talgar could make partial acquisitions impractical, as the remaining land may not be usable for farming or other purposes. This may have influenced the decision to acquire entire plots in some cases instead.
- Though the informant was not directly involved in earlier project stages, he mentioned that land departments typically provide input to the design team to optimise land acquisition. This could have been done to minimise fragmented plots in Talgar, leading to the entire acquisition of many plots to prevent creating unviable land fragments.
- The informant highlighted that some cases involve land reconfiguration, though this is not always feasible if no alternative land is available. This limitation could further explain why

some entire plots were acquired in Talgar, as reconfigurations may not have been possible for smaller or scattered plots.

Zhambyl District has a mix of partial and entire land acquisitions which may be influenced by ongoing industrial and infrastructure developments. Of the seven (7) land plots to be acquired, five (5) were classified as “other” land use, which could represent a mix of land uses, including industrial or infrastructure-related plots. The two (2) land plots which were partially acquired in Zhambyl District may reflect the fact that land plots in Zhambyl are relatively larger, and hence less likely to be fully acquired.

TABLE 7-23: EXTENT OF ACQUISITION OF PRIVATE LANDS PER DISTRICT

Category		**Proportion of Land Impacted (%)**											**Total**
		>0-10%	**>10-20%**	**>20-30%**	**>30-40%**	**>40-50%**	**>50-60%**	**>60-70%**	**>70-80%**	**>80-90%**	**>90-100%**	**Data Gap**	
Alatau City													
Peasant Farming	No. of Plots	17	4	6	2	1	0	1	0	2	1	1	35
	Proportion of No. of Plots (%)	48.57%	11.43%	17.14%	5.71%	2.86%	0.00%	2.86%	0.00%	5.71%	2.86%	2.86%	100.00%
Commercial Agriculture	No. of Plots	2	0	0	0	0	0	0	0	0	0	0	2
	Proportion of No. of Plots (%)	100.00%	0.00%										100.00%
Other	No. of Plots	1	0	0	0	0	0	0	0	1	1	0	3
	Proportion of No. of Plots (%)	33.33%	0.00%							33.33%	33.33%	0.00%	100.00%
Iliy District													
Peasant Farming	No. of Plots	35	4	2	2	1	2	1	1	8	7	2	65
	Proportion of No. of Plots (%)	53.85%	6.15%	3.08%	3.08%	1.54%	3.08%	1.54%	1.54%	12.31%	10.77%	3.08%	100.00%
Commercial Agriculture	No. of Plots	2	0	1	1	0	0	0	0	1	0	0	5
	Proportion of No. of Plots (%)	40.00%	0.00%	20.00%	20.00%	0.00%				20.00%	0.00%		100.00%
Other	No. of Plots	3	0	0	1	0	0	0	0	0	0	1	5

Category		Proportion of Land Impacted (%)											Total
		>0-10%	>10-20%	>20-30%	>30-40%	>40-50%	>50-60%	>60-70%	>70-80%	>80-90%	>90-100%	Data Gap	
	Proportion of No. of Plots (%)	60.00%	0.00%		20.00%	0.00%						20.00%	100.00%
Karasay District													
Peasant Farming	No. of Plots	2	0	0	0	0	0	0	0	0	0	0	2
	Proportion of No. of Plots (%)	100.00%	0.00%										100.00%
Commercial Agriculture	No. of Plots	0	1	0	0	0	0	0	0	0	0	0	1
	Proportion of No. of Plots (%)	0.00%	100.00%	0.00%									100.00%
Other	No. of Plots	1	0	0	0	0	0	0	0	0	0	0	1
	Proportion of No. of Plots (%)	100.00%	0.00%										100.00%
Talgar District													
Peasant Farming	No. of Plots	14	7	4	5	1	0	2	1	6	0	1	41
	Proportion of No. of Plots (%)	31.14%	17.07%	9.76%	12.20%	2.44%	0.00%	4.88%	2.44%	14.63%	0.00%	2.44%	100.00%
Commercial Agriculture	No. of Plots	0	0	0	0	0	0	0	0	0	0	0	0
	Proportion of No. of Plots (%)	Not applicable											

Category		**Proportion of Land Impacted (%)**											**Total**
		>0-10%	**>10-20%**	**>20-30%**	**>30-40%**	**>40-50%**	**>50-60%**	**>60-70%**	**>70-80%**	**>80-90%**	**>90-100%**	**Data Gap**	
Other	No. of Plots	0	0	0	0	0	0	0	0	0	0	0	0
	Proportion of No. of Plots (%)	Not applicable											
Zhambyl District													
Peasant Farming	No. of Plots	2	0	0	0	0	0	0	0	0	0	0	2
	Proportion of No. of Plots (%)	100.00%	0.00%										100.00%
Commercial Agriculture	No. of Plots	0	0	0	0	0	0	0	0	0	0	0	0
	Proportion of No. of Plots (%)	Not applicable											
Other	No. of Plots	4	0	0	0	0	0	0	0	1	0	0	5
	Proportion of No. of Plots (%)	80.00%	0.00%							20.00%	0.00%		100.00%

7.3.7.2 EXTENT OF ACQUISITION OF LEASED LANDS

The analysis of leased land plots in **Table 7-24** shows a clear trend towards partial acquisition rather than full acquisition. Out of 52 leased plots, 43 plots (82.69%) are partially acquired (<90%), whereas only seven (7) plots (13.46%) are fully acquired (≥90%). This suggests that most leased land users retain a portion of their land, potentially allowing for continued agricultural activities, albeit at a reduced scale.

Commercial agriculture makes up nine (9) partially acquired plots (20.93%) and only one (1) fully acquired plot (14.29%). This indicates that large-scale commercial operations are more likely to be partially affected rather than entirely acquired.

Leased farming constitutes 67.44% of partially acquired plots (29 plots) but only 57.14% of fully acquired plots (4 plots), reinforcing the prevalence of smallholder leased farming in the affected areas.

The "Other" category accounts for 11.63% of partially acquired plots (5 plots) and 28.57% of fully acquired plots (2 plots), suggesting that non-agricultural leased lands are more likely to be fully acquired compared to commercial agriculture or leased farming.

TABLE 7-24: EXTENT OF ACQUISITION OF LEASED LANDS ACROSS ALL DISTRICTS

Category	Total No. of Plots	Proportion of No. of Plots
Partially Acquired (<90%)	**43**	**100.00%**
Commercial Agriculture	9	20.93%
Leased Farming	29	67.44%
Other	5	11.63%
Entirely Acquired (≥90%)	**7**	**100.00%**
Commercial Agriculture	1	14.29%
Leased Farming	4	57.14%
Other	2	28.57%

The district-level analysis in **Table 7-25** reveals key differences in land acquisition strategies across districts:

- Alatau City, Karasay, and Talgar districts have exclusively partially acquired plots, with no cases of full acquisition. This suggests that in these areas, landowners have retained portions of their leased lands, likely mitigating the impact of acquisition.
- Iliy District has the highest number of affected leased plots (24 partially acquired, six (6) fully acquired), making it the focal point of land acquisition in the project area.
- Zhambyl District follows a similar pattern to Iliy, with a predominance of partially acquired plots and no fully acquired ones. However, its smaller overall number of affected plots suggests a more limited impact in comparison.
- Peasant farming dominates across all districts, with 100% of partially acquired plots in Alatau and Karasay consisting of peasant farms. In contrast, commercial agriculture is only present in Iliy District, where nine (9) out of 24 partially acquired plots fall into this category (37.5%).

- The “Other” category is most prominent in Iliy District, where it accounts for four (4) partially acquired plots (16.67%) and two (2) fully acquired plots (33.33%). Other districts have very few or no plots in this category.
- Zhambyl and Iliy Districts are the primary locations for full acquisitions, while Karasay, Talgar, and Alatau City see only partial acquisitions.
- There is an overall lowered risk of land fragmentation on leased land plots, though specific cases of possible fragmentation need to be further assessed.

TABLE 7-25: EXTENT OF ACQUISITION OF LEASED LANDS BY DISTRICT

Category		**Proportion of Land Impacted (%)**											**Total**
		>0-10%	**>10-20%**	**>20-30%**	**>30-40%**	**>40-50%**	**>50-60%**	**>60-70%**	**>70-80%**	**>80-90%**	**>90-100%**	**Data Gap**	
Alatau City													
Commercial Agriculture	No. of Plots	0	0	0	0	0	0	0	0	0	0	0	0
	Proportion of No. of Plots (%)	Not applicable											
Leased Farming	No. of Plots	5	1	2	0	0	0	0	1	0	0	0	9
	Proportion of No. of Plots (%)	55.56%	11.11%	22.22%	0.00%				11.11%	0.00%			100.00%
Other	No. of Plots	0	0	0	0	0	0	0	0	0	0	0	0
	Proportion of No. of Plots (%)	Not applicable											
Iliy District													
Commercial Agriculture	No. of Plots	5	0	0	0	1	0	1	0	1	2	0	10
	Proportion of No. of Plots (%)	50.00%	0.00%			10.00%	0.00%	10.00%	0.00%	10.00%	20.00%	0.00%	100.00%
Leased Farming	No. of Plots	6	0	0	1	0	0	2	1	2	1	1	14
	Proportion of No. of Plots (%)	42.86%	0.00%		7.14%	0.00%		14.29%	7.14%	14.29%	7.14%	7.14%	100.00%
Other	No. of Plots	4	0	0	0	0	0	0	1	0	2	1	8

Category		Proportion of Land Impacted (%)											Total
		>0-10%	>10-20%	>20-30%	>30-40%	>40-50%	>50-60%	>60-70%	>70-80%	>80-90%	>90-100%	Data Gap	
	Proportion of No. of Plots (%)	60.00%	0.00%		20.00%	0.00%						20.00%	100.00%
Karasay District													
Commercial Agriculture	No. of Plots	0	0	0	0	0	0	0	0	0	0	0	0
	Proportion of No. of Plots (%)	Not applicable											
Leased Farming	No. of Plots	1	0	0	0	0	0	0	0	0	1	0	2
	Proportion of No. of Plots (%)	50.00%	0.00%								50.00%	0.00%	100.00%
Other	No. of Plots	0	0	0	0	0	0	0	0	0	0	0	0
	Proportion of No. of Plots (%)	Not applicable											
Talgar													
Commercial Agriculture	No. of Plots	0	0	0	0	0	0	0	0	0	0	0	0
	Proportion of No. of Plots (%)	Not applicable											
Leased Farming	No. of Plots	3	2	0	0	0	0	0	0	0	0	0	5
	Proportion of No. of Plots (%)	60.00%	40.00%	0.00%									100.00%

Category		**Proportion of Land Impacted (%)**											**Total**
		>0-10%	**>10-20%**	**>20-30%**	**>30-40%**	**>40-50%**	**>50-60%**	**>60-70%**	**>70-80%**	**>80-90%**	**>90-100%**	**Data Gap**	
Other	No. of Plots	0	0	0	0	0	0	0	0	0	0	0	0
	Proportion of No. of Plots (%)	Not applicable											
Zhambyl													
Commercial Agriculture	No. of Plots	0	0	0	0	0	0	0	0	0	0	0	0
	Proportion of No. of Plots (%)	Not applicable											
Leased Farming	No. of Plots	2	0	1	0	0	0	0	0	0	0	0	3
	Proportion of No. of Plots (%)	66.67%	0.00%	33.33%	0.00%								100.00%
Other	No. of Plots	1	0	0	0	0	0	0	0	0	0	0	1
	Proportion of No. of Plots (%)	100.00%	0.00%										100.0%

7.3.8 ECONOMY, EMPLOYMENT AND INCOME

Key pre-Project economic baseline information to consider for the assessment of impacts on the local and national economy includes the following:

- The regional economy in Almaty
- Local economy in Alatau City
- Local economy in Karasay district
- Local economy in Zhambyl district
- Local economy in Iliy district
- Local economy in Talgar district
- Employment and unemployment rates
- Income and livelihoods

7.3.8.1 THE REGIONAL ECONOMY IN ALMATY

The Almaty Region's economic growth in 2024 has been significantly influenced by its strategic position along the Middle Corridor, also known as the Trans-Caspian International Transport Route. This corridor is a vital trade route connecting Southeast Asia and China to Europe via Central Asia, the Caspian Sea, the Caucasus, and Turkey, offering a shorter alternative to traditional northern and southern routes.

Almaty Region's location along the Middle Corridor has enhanced its role as a key transit hub, facilitating increased trade flows between Asia and Europe. This strategic advantage has attracted investments in infrastructure and logistics, contributing to the region's Gross Regional Product (GRP) growth.

The GRP in the Almaty Region increased by 7.3% in 2024. The key sectors contributing to the GRP are services (53.2%) and goods and production (40.1%). Growth in services is fuelled by the retail and wholesale trade which is seeing strong consumer demand, and a growing demand for paid services like housing, transport and utilities leading to a 9.4% increase in service prices.

The other primary driver of growth is in industrial production. In particular, the manufacturing industry has seen a 6.1% in growth and the utilities sector has seen a 13.3% growth. This reflects a diversification in manufacturing production, and an expansion of energy, gas and water supply services caused by increasing Urbanisation in the Almaty region.

The construction sector has also been a key driver of GRP growth, with a 23% surge in 2024. This is due to an increased investment in fixed capital and expansion in housing development. To support the increased transit traffic, significant infrastructure projects have been initiated in the Almaty Region. These include the development of railway bypasses around the Almaty metropolitan area to alleviate congestion and improve the efficiency of freight movement along the corridor (such as this Project) [268].

Although majority of the employed population in Almaty are employed in agricultural production, the sector contributes to only 14.2% of the GRP in the Almaty Region

[268] World Bank. (2024). *10 priority actions that can triple trade in the Middle Corridor by 2030*. Retrieved 5 December 2024, from https://www.worldbank.org/en/region/eca/brief/10-priority-actions-that-can-triple-trade-in-the-middle-corridor-by-2030?

(2023)[269,270]. This reflects a common economic pattern where agriculture employs a significant workforce but generates relatively low economic value compared to sectors like services and industry. A similar trend is observed at the national level—agriculture accounted for 11.9% of Kazakhstan's workforce in 2023[271] but contributed only 4.3% to the country's Gross Domestic Product (GDP)[272]. Additionally, Kazakhstan's agricultural output contracted by 8.3% in 2023, driven by climate change-induced droughts, outdated farming technology, labour shortages, and environmental degradation[273,274]. Despite these challenges, Almaty Region remained relatively stable, with the agricultural output contracting by only 0.3% in 2023, likely due to more favourable climatic conditions, diversified agricultural activities, and better access to water resources.

The GRP growth is supported by a 13.1% increase in nominal wages and a 3.8% rise in real cash income in the Almaty region, leading to higher disposable incomes and greater consumer spending, encouraging economic activity.

The Project is poised to significantly impact the larger Almaty Region, particularly within these administrative districts:

- Karasay District: Located near Almaty city, this district is expected to experience enhanced connectivity and economic opportunities due to the bypass, facilitating industrial and logistical developments.
- Iliy District: Hosting the Boraldai and Berek industrial zones, Ili District stands to benefit from improved freight movement, attracting high-tech and innovative enterprises.
- Talgar District: Known for its agricultural production, Talgar District may see increased access to markets and resources, bolstering both agricultural and industrial sectors.
- Zhambyl District: With ongoing industrial projects, including the Kazbek Bek industrial zone, Zhambyl District is likely to experience accelerated economic growth due to improved transportation infrastructure.

7.3.8.2 LOCAL ECONOMY IN ALATAU CITY

Established in January 2024, Alatau City is part of the expansive Alatau Special Economic Zone (SEZ), covering approximately 96,500 hectares. The Alatau SEZ, encompassing the entire city and part of Konaev, is projected to host over 170 projects, aiming to create

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[269] Bureau of National Statistics. (2024). *Gross output of agricultural products (services) by regions*. Retrieved 6 February 2025, from https://stat.gov.kz/en/industries/business-statistics/stat-forrest-village-hunt-fish/publications/158993/

[270] Bureau of National Statistics. (2024). *Gross regional product (January – December 2023)*. Retrieved 6 February 2025, from https://stat.gov.kz/en/industries/economy/national-accounts/publications/157630/

[271] Bureau of National Statistics. (2024). *Main indicators of the labour market in the Republic of Kazakhstan (2023)*. Retrieved February 6, 2025, from https://stat.gov.kz/en/industries/economy/foreignmarket/publications/163686/

[272] Bureau of National Statistics. (2024). *GDP by method of production (January-December 2023)*. Retrieved 6 February 2025, from https://stat.gov.kz/en/industries/economy/national-accounts/publications/157626/

[273] Nakispekova, A. (2024). *Kazakhstan to boost food security by 2035, say experts*. Retrieved 6 February 2025, from https://astanatimes.com/2024/08/kazakhstan-to-boost-food-security-by-2035-say-experts/

[274] Zhusupova, A. (2024). *Kazakhstan: Plan to boost agricultural output overlooks farm workers*. Retrieved 6 February 2025, from https://eurasianet.org/kazakhstan-plan-to-boost-agricultural-output-overlooks-farm-workers

approximately 110,000 jobs[275]. The TULIP industrial zone is expected to serve as a foundation for forming the new city, with the creation of many jobs leading to a concentration of people in the new territory[276].

The Alatau City project is strategically positioned along the "New Silk Road," aiming to become a global financial, export-oriented, and tourist centre[277]. The city is also set to implement comprehensive digitization and automation across all necessary processes, positioning it as a smart city and attracting technology-driven industries[278].

7.3.8.3 LOCAL ECONOMY IN KARASAY DISTRICT

The Karasay District, located near Almaty city, has experienced notable economic activities in recent years. The district's economy comprises a mix of industrial development, agricultural production, and infrastructure investments[279].

A key feature of the district's agricultural sector is the establishment of the "Eurasian Green Product" greenhouse complex, which employs Dutch technology for tomato production. The facility integrates seed collection and seedling cultivation processes, contributing to local agricultural output[280].

Industrial and logistical infrastructure in the district has been supported by investments, including the implementation of 16 projects valued at $600 million across the Almaty Region, with several located in Karasay. These projects include the construction of production and logistics centres, such as facilities for medical supplies and ice cream production and are designed to create employment opportunities[281].

7.3.8.4 LOCAL ECONOMY IN ZHAMBYL DISTRICT

The Zhambyl district has been focusing on industrial development and infrastructure enhancement to stimulate its local economy. The district is home to the village of Ulken, identified as the preferred site for Kazakhstan's first nuclear power plant. This project is expected to attract significant investment and create numerous job opportunities, thereby boosting the district's economic profile[282].

In addition to energy projects, the district has been developing industrial zones to attract businesses and foster economic growth. The Kazbek Bek industrial zone, for instance, is part of the region's strategy to establish areas conducive to high-tech and innovative

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[275] Goulard, S. (2024). *The Alatau special economic zone*. Retrieved 5 December 2024, from https://globalconnectivities.com/2024/03/alatau-special-economic-zone/

[276] KAZAKH INVEST. (2024). *KAZAKH INVEST discusses progress of the Alatau City project*. Retrieved 5 December 2024, from https://invest.gov.kz/media-centre/press-releases/kazakh-invest-discusses-progress-of-the-alatau-city-project/

[277]Caspian Group. (2024). *Alatau city*. Retrieved 5 December 2024, from https://caspian.kz/en/project_groups/2

[278] KAZAKH INVEST. (2024). *SEZ and IZ*. Retrieved 5 December 2024, from https://almaty.invest.gov.kz/doing-business-here/special-economic-zone/

[279] Akimat of the Karasay District. (2024). *Akimat of the Karasay District*. Retrieved December 5, 2024, from https://www.gov.kz/memleket/entities/almobl-karasay?lang=en

[280] KAZAKH INVEST. (2024). *SEZ and IZ*. Retrieved 5 December 2024, from https://almaty.invest.gov.kz/doing-business-here/special-economic-zone/

[281] KAZAKH INVEST. (2024). *SEZ and IZ*. Retrieved 5 December 2024, from https://almaty.invest.gov.kz/doing-business-here/special-economic-zone/

[282] KAZAKH INVEST. (2024). *Economy*. Retrieved 5 December 2024, from https://almaty-region.invest.gov.kz/about/economy/

production.[283] In September 2024, it was announced that China's CITIC Construction plans to invest over $1 billion to build a deep grain processing plant in the Kazbek Bek industrial zone. The facility is expected to process up to 300,000 tons of wheat annually, producing products such as maltose syrup, fructose syrup, crystalline fructose, allulose, crystalline dextrose, sodium gluconate, gluten by-products, and feed. This project is anticipated to create more than 2,000 jobs, significantly contributing to the district's economic growth[284].

7.3.8.5 LOCAL ECONOMY IN ILIY DISTRICT

The district hosts the Boraldai and Berek industrial zones, which are integral to the region's efforts to attract enterprises focused on high-tech, innovative, and environmentally friendly products.[285]

The district's proximity to Almaty City facilitates economic integration, providing businesses with access to urban markets and resources. This advantageous location has spurred the development of industrial zones and special economic areas, fostering a conducive environment for business operations and attracting both domestic and foreign investments[286].

7.3.8.6 LOCAL ECONOMY IN TALGAR DISTRICT

Talgar District, located near Almaty city, focuses on agricultural development and industrial diversification to bolster its local economy. The district is known for its agricultural production, particularly in horticulture and livestock farming. Efforts are underway to modernise agricultural practices and enhance productivity through the adoption of advanced technologies.

In terms of industrial development, the Kairat industrial zone in Talgar District is part of the region's strategy to establish areas conducive to high-tech and innovative production[287].

The district's proximity to Almaty city provides access to urban markets and resources, facilitating economic integration and attracting investments. This strategic location has been instrumental in the district's efforts to develop its industrial and agricultural sectors.

7.3.8.7 EMPLOYMENT AND UNEMPLOYMENT RATES IN THE ALMATY REGION

In the Almaty region, as of 2024, the labour force participation rate is at 71.3%. For the population of working age, 90.2% are engaged in employment. Men have a higher labour force participation rate compared to women across both the general and working age populations. The labour participation rate in the general population and working population is reflected in **Table 7-26**. The higher participation rate for the working population in

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[283] Staff Report. (2021). *Almaty region to attract nearly $2 billion of investments in 2021*. Retrieved 5 December 2024, from https://astanatimes.com/2021/07/almaty-region-to-attract-nearly-2-billion-of-investments-in-2021/
[284] Aliyeva, A. (2024). *China to spend $1 billion to build new plant in Almaty region*. Retrieved 5 December 2024, from https://www.azernews.az/region/231765.html
[285] KAZAKH INVEST. (2024). *Economy*. Retrieved 5 December 2024, from https://almaty-region.invest.gov.kz/about/economy/
[286] SPK Almaty. (2023). *The industrial zone of Almaty has joined the UN Global Compact*. Retrieved 3 December 2024, from https://spkalmaty.kz/en/news/the-industrial-zone-of-almaty-has-joined-to-the-un-global-compact/
[287] Staff Report. (2021). *Almaty region to attract nearly $2 billion of investments in 2021*. Retrieved 3 December 2024, from https://astanatimes.com/2021/07/almaty-region-to-attract-nearly-2-billion-of-investments-in-2021/

comparison to the general population indicates that many individuals outside the working age range as stipulated by national regulations are not part of the labour force.

TABLE 7-26: EMPLOYMENT RATES IN THE ALMATY REGION

Description	Employment Rate
Percentage of People Employed in the General Population	71.3%
Percentage of Men Employed in the General Population	77.0%
Percentage of Women Employed in the General Population	65.8%
Percentage of Employed Persons in Working Age Population	90.2%
Percentage of Men Employed in Working Age Population	94.1%
Percentage of Women Employed in Working Age Population	86.2%

Source: Department of Labour Statistics and Living Standards. (2024). *Main indicators of the labour market in the Republic of Kazakhstan (3rd quarter 2024)*. Retrieved 2 December 2024, from https://stat.gov.kz/en/industries/labour-and-income/stat-empt-unempl/publications/236923/

The official unemployment rate for the region is 4.7%, with men at 5.0% and women at 4.3%. Unemployment is highest among youths aged 16 to 24 and older workers aged 55 to 64.

7.3.8.8 INCOME AND LIVELIHOODS IN ALMATY REGION

The average monthly wage in Kazakhstan during the first quarter of 2024 was 382,279 tenge (USD $738), reflecting a 12.3% increase compared to the corresponding quarter in 2023. However, the median wage stood at 251,997 tenge (USD $486), substantially lower than the average, highlighting significant income disparities. The gap suggests that higher earners, particularly in lucrative sectors such as mining, finance, and information technology, skew the wage distribution. At the lower end, the minimum wage was set at 85,000 tenge (USD $164) [288] as of January 2024, underscoring the challenges faced by workers in sectors with limited earning potential, such as agriculture and education.

Income levels vary widely across economic sectors, with specialised and capital-intensive industries offering the highest wages. Mining and quarrying recorded the highest average monthly wage at 864,029 tenge (USD $1,739), over 2.3 times higher than the national average. Financial and insurance activities offered an average monthly wage of 780,876 tenge (USD $1,572), followed by Information and Communication at 654,902 tenge (USD $1,318). Conversely, labour-intensive and public service-oriented sectors such as agriculture (212,300 tenge or USD $427), education (284,992 tenge or USD $574), and healthcare (294,443 tenge or USD $593) displayed the lowest wage levels. These disparities underscore the structural inequalities between industries requiring specialised skills or capital investment and those reliant on manual or routine labour.

Within the Almaty region, employment is distributed across various sectors illustrated **Table 7-23**. The largest proportion of employed persons work in the agriculture, forestry and fisheries sector (17.74%). Other major sectors of employment include:

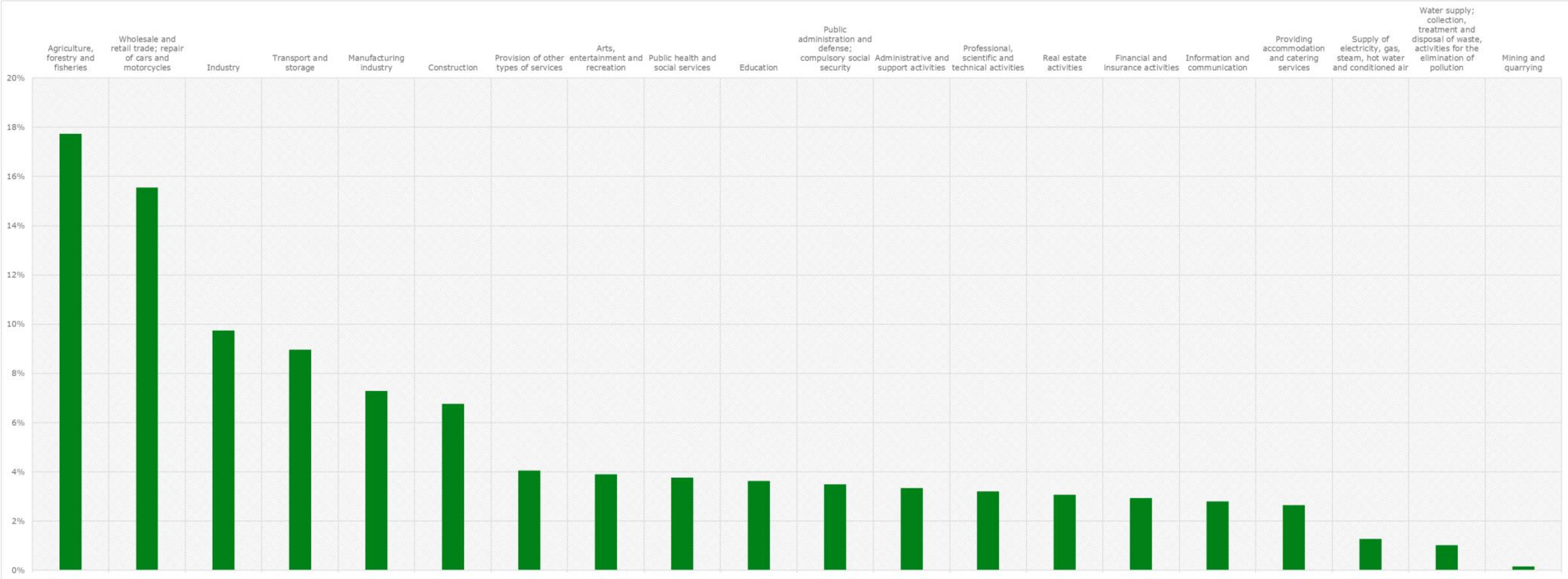
[288] Kazakhstan does not have an established living wage.

- Wholesale and retail trade; repair of cars and motorcycles (15.55%);
- Industry (9.73%);
- Transport and storage (8.97%);
- Construction (6.76%); and
- Provision of other types of services (4.04%) among others.

TABLE 7-27: EMPLOYMENT SUBCATEGORIES IN MAJOR SECTORS OF EMPLOYMENT

Employment Sector	Subcategories
Agriculture	Crop production, livestock production, agricultural support services (e.g. farm supply chain manager, logistics and transport workers for product delivery).
Forestry	Workers planting and maintaining trees, loggers and woodcutters, wildlife conservationists, among others.
Fisheries	Capture fisheries, aquaculture, and related support services.
Wholesale and retail	Retail stores, automotive repair services and maintenance.
Industry	Mining and quarrying, manufacturing, supply of electricity, gas, steam, hot water and conditioned air, water supply; collection treatment and disposal of waste, activities for the elimination of pollution.
Transport and storage	Freight and logistics, passenger transport, warehousing and cold storage facilities, port and terminal operations.
Construction	Residential, commercial and infrastructure projects

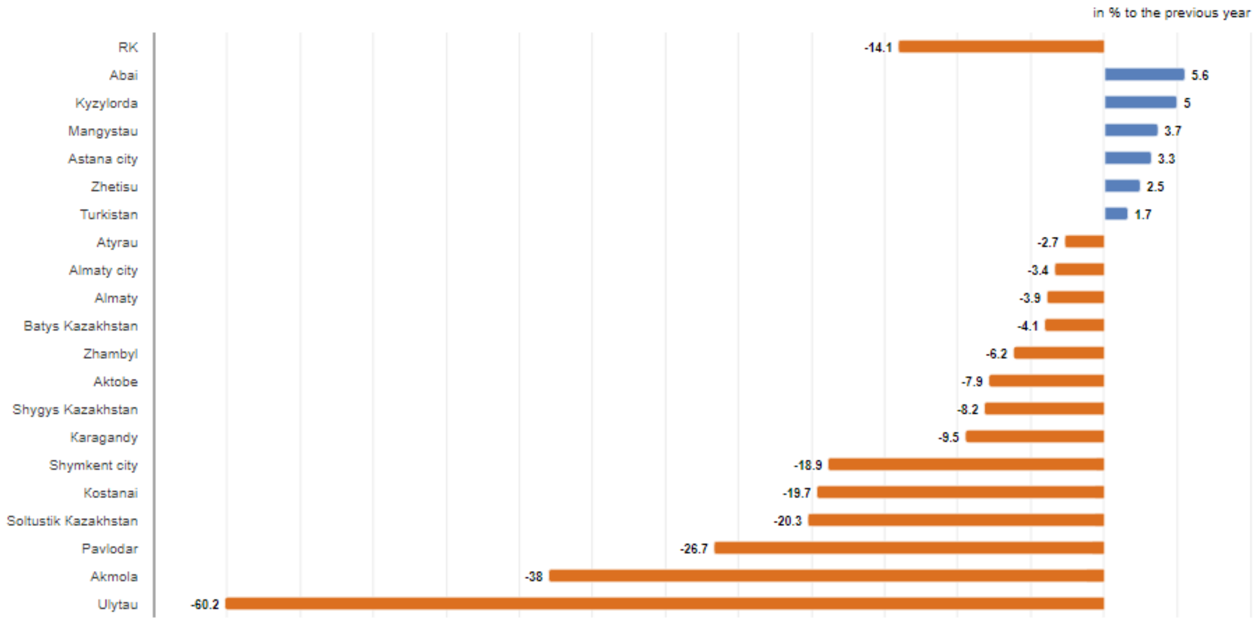
TABLE 7-28: PROPORTION OF WORKFORCE EMPLOYED PER SECTOR IN ALMATY REGION



The gross output of products and services of the agriculture, forestry and fisheries sector in Kazakhstan in 2023 was 7,625.2 billion tenge (USD $14.71 billion), amounting to 5.60% of the country's GDP (USD $262.6 billion)[289]. Economic growth in Kazakhstan is primarily driven by the industrial sector, followed by the wholesale and retail trade and vehicle repair, which account for 26.7% and 18.2% of the GDP respectively[290]. While the agriculture, forestry and fisheries sector is not a primary contributor to the country's GDP, it remains important due to the large number of population employed in the sector, especially among the rural population.

Overall, the production of crops has decreased by 14.1% in the Republic of Kazakhstan between 2022 and 2023. Within the agriculture, forestry and fisheries sector, the output for agricultural crops has been declining in most regions (**Figure 7-9**). Almaty has seen a smaller decrease in crop production, recording a decrease of 3.9% in comparison to the national average of 14.1%. This can be attributed to the region's primarily rural population and dependency on agriculture as a livelihood means.

FIGURE 7-9: INDICES OF THE PHYSICAL VOLUME OF CROP PRODUCTION IN KAZAKHSTAN



In comparison, the output for livestock has been growing across most regions, including in Almaty. The average increase in livestock production across Kazakhstan was 4.5%. Almaty city posed a significant outlier, with a drastic decline of 59.1% in livestock output in comparison to Astana city and Ulytau, which saw a decline of 1.5% and 2.3% respectively.

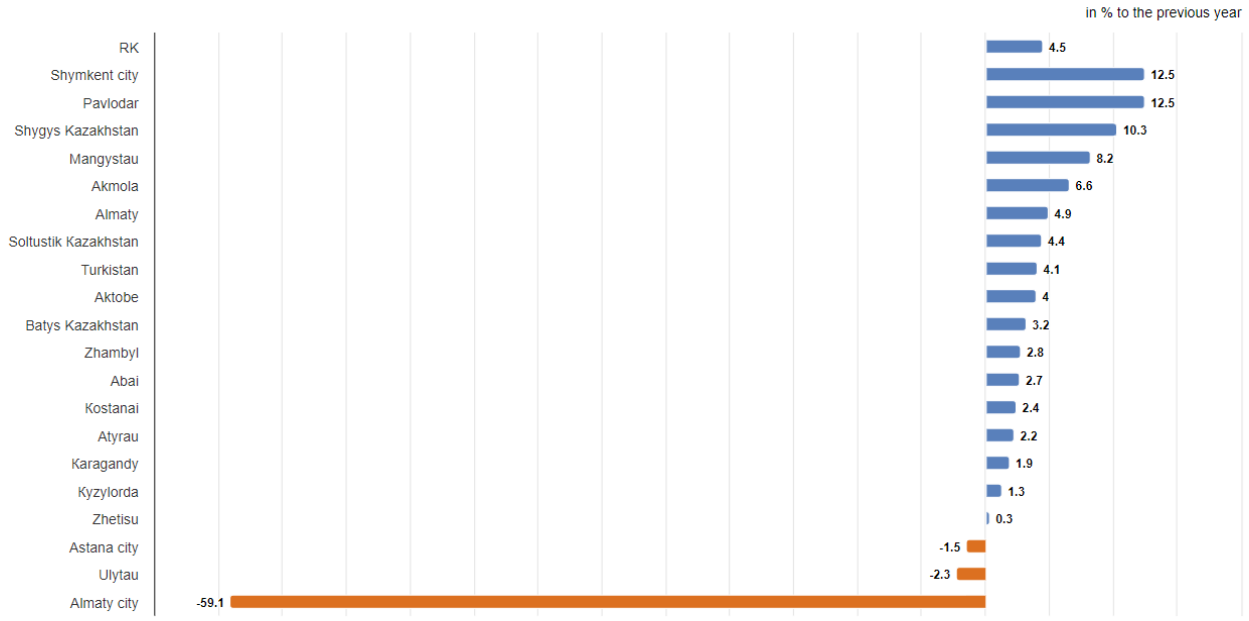
289 Department of Agricultural Statistics and National Censuses. (2024). *Gross output of agricultural products (services) by regions*. Retrieved 2 December 2024, from https://stat.gov.kz/en/industries/business-statistics/stat-forrest-village-hunt-fish/publications/158993/
290 Abuova, N. (2024). *Kazakhstan's economic performance: Key sectors drive growth*. Retrieved 2 December 2024, from https://astanatimes.com/2024/08/kazakhstans-economic-performance-key-sectors-drive-growth/#:~:text=In%202023%2C%20the%20production%20of,%2C%20which%20accounted%20for%2018.2%25.

Livestock activities are central to the rural agricultural economy, particularly when considering the land characteristics of the Project's SAoI.

During a consultation on 5 November 2024, the Akim of Kazybek Bek provided insights into land ownership and livestock management within the village. Each household typically owns 100m^2 of land, with 50m^2 designated for residential purposes and the remaining 50m^2 utilised for personal farming. To maintain and assess livestock populations, an animal veterinary survey is conducted biannually. This survey counts the number of livestock in the village—primarily sheep, cows, and horses—and adjusts the total livestock population based on demand and the regeneration rate of grassland. The Akim explained that each working adult farmer is entitled to own two cows, contingent upon meeting specific land requirements for grazing: one (1) horse or cow per three (3) hectares and one (1) sheep or goat per 1.5 hectares. During the consultations, the Akim mentioned that upon the latest of the animal veterinary survey conducted, the village is permitted an increase in the overall livestock population compared to the previous year, reflecting a responsive approach to agricultural and market conditions.

In summary, the land ownership structure and livestock management practices in Kazybek Bek are designed to support both residential living and sustainable farming, enabling residents to optimise their agricultural output while adhering to specific regulatory requirements.

FIGURE 7-10: INDICES OF THE PHYSICAL VOLUME OF LIVESTOCK PER REGION IN KAZAKHSTAN



Source: Department of Agricultural Statistics and National Censuses. (2024). *Main indicators of agricultural statistics*. Retrieved 2 December 2024, from https://stat.gov.kz/en/industries/business-statistics/stat-forrest-village-hunt-fish/publications/158993/

Across the different employment sectors, there are clear gender disparities. Women are primarily concentrated in education and care roles while men largely dominate sectors such as construction, transport and technology. The gender ratio in each sector is described below in **Figure 7-11**. The sectors with the strongest female presence are:

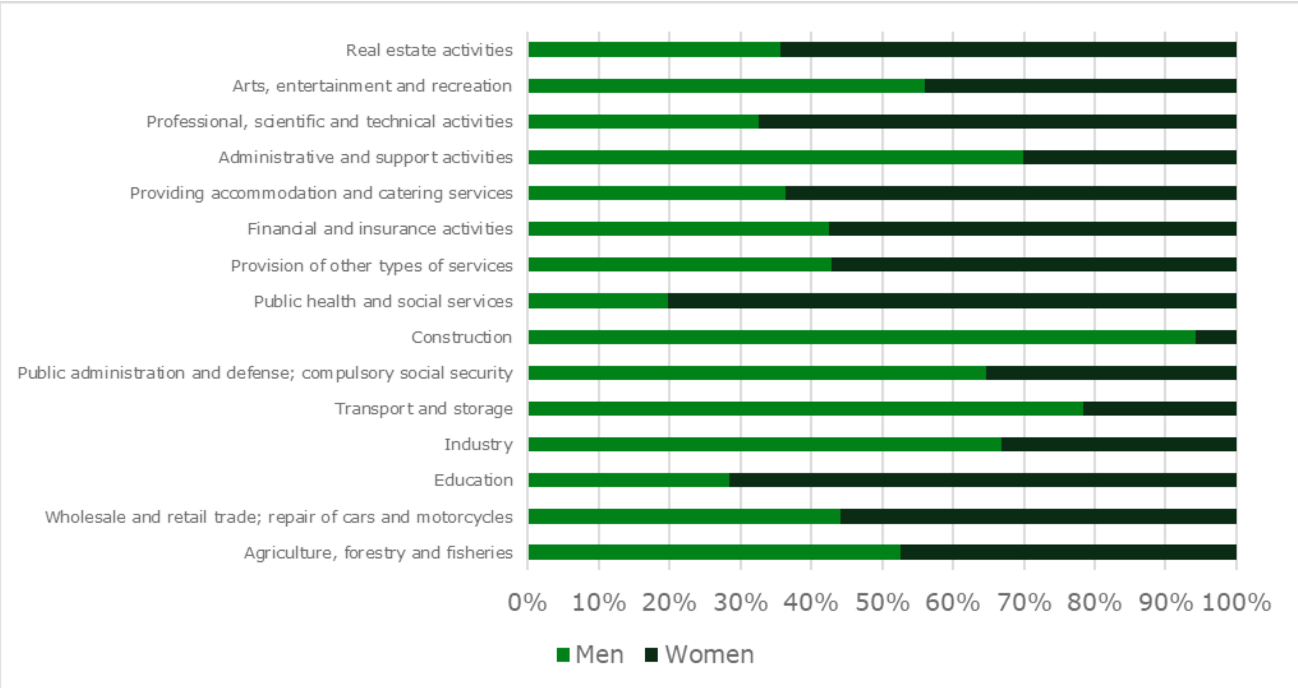
- Public health and social services (80.13% female);
- Education (71.52% female);
- Professional, scientific and technical activities (67.38% female);
- Real estate activities (64.39% female); and
- Providing accommodation and catering services (63.67% female).

The sectors with the strongest male presence are:

- Construction (94.32% male);
- Transport and storage (78.32% male);
- Administrative and support activities (69.97% male);
- Industry (66.84% male); and
- Public administration and defense; compulsory social security (64.70% male).

The agriculture, forestry and fisheries sector is relatively gender-balanced amongst the other sectors as recorded in the national census, though there is a slightly larger proportion of men than women in the sector with a gender ratio of 0.90 women for every man (52.57% male, 47.43% female).

FIGURE 7-11: GENDER RATIO PER EMPLOYMENT SECTOR IN ALMATY



Source: Department of Agricultural Statistics and National Censuses. (2024). *Main indicators of agricultural statistics*. Retrieved 2 December 2024, from https://stat.gov.kz/en/industries/business-statistics/stat-forrest-village-hunt-fish/publications/158993/

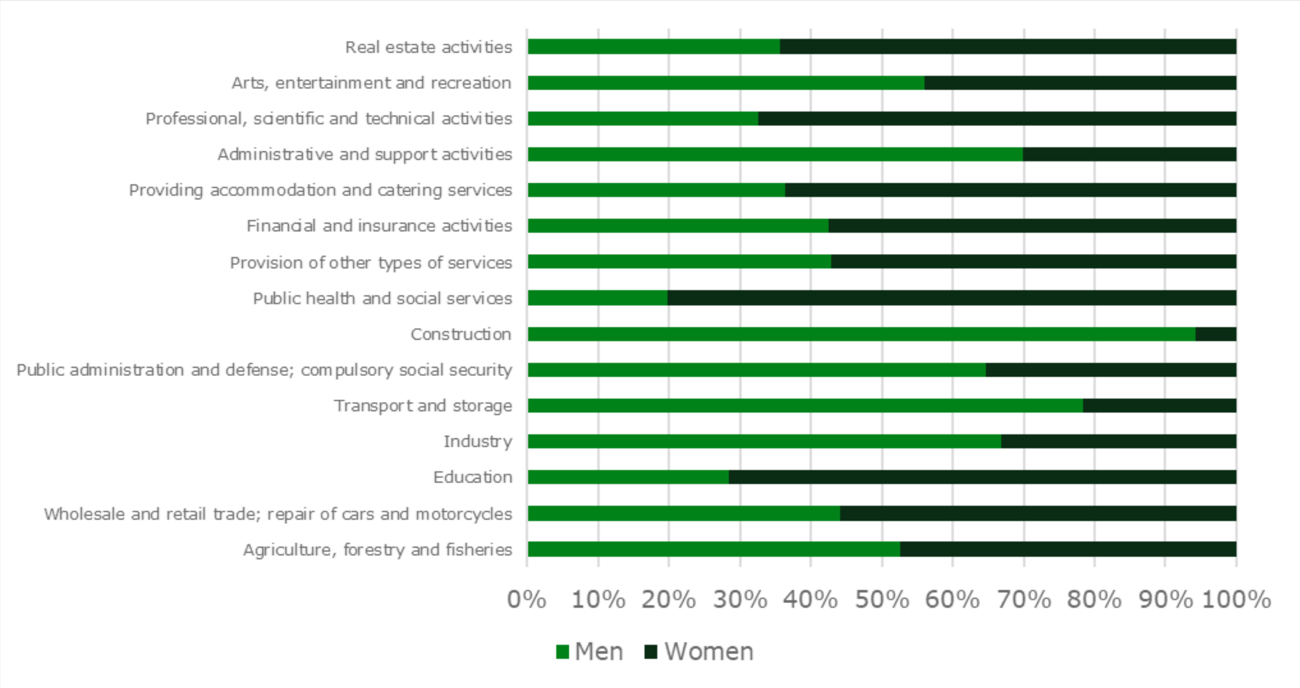
The national census classifies workers and farmers in the agricultural, forestry and fisheries sector into the following occupations:

- farmers and agricultural workers producing products for sale;
- hunters and workers for the production of forestry and fish products; and

- agricultural, fish and fishery farmers producing products for personal consumption.

A larger proportion of men is involved across the three occupations as delineated **Figure 7-12** below. 72.32% of the those who work as hunters and workers for the production of forestry and fish products are male, with the remaining 27.68% being female. Females are better represented as agricultural, forestry and fishery farmers and as agricultural workers producing products for sale. The occupations mentioned comprise of 50.24% men and 60.15% men respectively.

FIGURE 7-12: GENDER DISTRIBUTION FOR AGRICULTURAL, FORESTRY AND FISHERY WORKERS IN KAZAKHSTAN



Source: Department of Labour Statistics and Living Standards (2024) The Main Indicators of the Labour Market in the Republic of Kazakhstan (III quarter of 2024), available at: https://stat.gov.kz/en/industries/labour-and-income/stat-empt-unempl/publications/236923/, accessed 2 December 2024.

In urban areas, only 7.00% of the employed population work in the agricultural, forestry and fisheries sector. Instead, most people are employed in the education sector (13.50%), engaged in the wholesale and retail trade (13.25%), industry (12.13%), public administration (11.83%) and transport and storage (8.75%) among others.

In comparison, 19.84% of the employed rural population in Almaty region is primarily engaged in agriculture, forestry and fisheries. Other prominent sectors in rural employment include the wholesale and retail trade (16.00%), the education sector (10.90%), industry (9.27%), transport and storage (9.01%) as well as the manufacturing industry (7.04%) among others.

About 69.3% of employed individuals are wage-based employees, while 30.7% are self-employed. Of the employed population, 16.3% of the self-employed persons are part of the urban population in Almaty while 83.7% of self-employed persons live in rural settlements in the region. The stark difference suggests a likely lack of formal livelihood opportunities in rural areas in comparison to urban areas in the region. Within the agriculture, forestry and fisheries sector in the Almaty region, females are better represented as agricultural, forestry and fishery farmers and as agricultural workers producing products for sale. According to respondents interviewed by ERM within the SAoI, women tend to avoid taking on work involving husbandry and livestock due to the perceived physical effort and laborious requirements of the job.

There is a total of 220,541 self-employed workers in the Almaty region, of which 87.97% are part of the rural population. There are over seven (7) times more self-employed rural workers than there are self-employed urban workers. Notably, rural residents seem to be more economically vulnerable. The proportion of workers who are unproductively employed in a rural setting is about twice as large as that in an urban population (**Table 7-29).**

TABLE 7-29: SELF-EMPLOYED URBAN AND RURAL WORKERS IN ALMATY REGION

Self-Employed Urban Workers: 26,528		**Self-Employed Rural Workers: 194,013**	
Productively Employed	*Unproductively Employed*	*Productively Employed*	*Unproductively Employed*
23,286 (87.78%)	3,242 (12.22%)	150,975 (77.82%)	43,038 (22.18%)

7.3.8.9 INCOME AND LIVELIHOODS OF PROJECT-AFFECTED PERSONS

Based on the information received by ERM, the primary land uses of the cadastral plots were officially registered as Peasant farming, Leased farming, Commercial agriculture and Other. ERM verified on site that the terms farming and agriculture are used interchangeably to refer to both crop production and the rearing of livestock in the Project's SAoI. The primary source of livelihood of those in the agricultural sector in the Project's SAoI is livestock production. The agricultural products produced include grass, clover, apples and hay while the livestock reared include sheep, cattle, horses, goats, turkeys and chickens.

Locals consulted shared youths generally are not a prominent group in the agriculture or livestock sector. This is as there is a small proportion of young people residing in the Project's SAoI, particularly in rural areas. Youths leave for more urban areas or to cities to pursue secondary or higher education, and for employment opportunities.

The majority of respondents likely to be impacted by the Project rely on formal employment for their livelihoods. The discrepancy between the responses received through the SSIs and the broader pattern in relation to livelihoods in the SAoI is likely due to settlement patterns and the location of the Project alignment. The affected households surveyed in the SSIs may be located closer to urban areas (e.g. Alatau City), where formal employment opportunities (e.g., in services, trade, or public sector jobs) are more accessible. In contrast, agricultural livelihoods dominate in more rural areas, which may not have been the focus of the interviews due to the specific location of the Project alignment.

Additionally, due to limitations in sampling described in **Section 7.1,** the SSIs may have inadvertently over-sampled respondents in peri-urban or semi-urban settlements, where formal employment is more common. Hence, the following information provides indicative insights into the income sources and livelihoods of Project-affected persons, reflecting patterns observed in the SSIs while acknowledging broader district-level economic trends.

Among the 46 respondents who shared details about their primary occupation (based on time spent):

- 12 respondents (26%) identified agriculture as their primary occupation.
- 6 respondents (13%) identified livestock rearing as their primary occupation.

- 16 respondents (35%) reported being employees or businessmen, indicating a significant share of formal or entrepreneurial employment.
- 3 out of 46 respondents (7%) were retirees.
- Other occupations, such as homemaking, tutoring, rotational oil field work made up the remaining 19%.
- 36 out of 45 respondents[291] (80%) reported having no secondary occupation.

However, when asked about their main source of income (whether from formal or informal employment), responses varied:

- 13 respondents (28.3%) reported business entrepreneurship as their primary source of income, making it the most common income source.
- 8 respondents (17.4%) identified agriculture as their main source of income.
- 11 respondents (23.9%) earned their main income from salary-based employment.
- 5 respondents (10.9%) fell under the PND (Prefer Not to Disclose) category, indicating no regular income source.
- 4 respondents (8.7%) relied on pension payments as their primary income source.
- 3 respondents (6.5%) derived their main income from livestock rearing.
- 1 respondent (2.2%) cited benefits as their main income source.
- 1 respondent (2.2%) reported tutoring as their primary income.

This data indicates that while agriculture and livestock remain significant, there is a strong reliance on business and salaried employment as income sources. Notably, business entrepreneurship accounts for the largest share of reported main income sources (28.3%), reflecting an economic environment where self-employment and trade play a critical role.

For the locals who depend on agriculture and livestock as livelihood means, the likelihood of success is broadly determined by the availability of suitable land for the purpose of livelihood activities. For instance, farming crops is only possible if there is water infrastructure available and accessible on the land plot. As water infrastructure is not readily available, most of the population's livelihoods are broadly dependent on livestock production. Larger land plots are more likely to be able to host a greater number of livestock. ??

Farming enterprises tend to hold larger plots of land and are able to maintain larger herds of livestock. Due to the availability of the land, they generally are able to grow their own hay. However, individuals tend to hold smaller land plots of around five (5) to ten (10) hectares and will hence focus on livestock rearing. Smaller farms or individual owners often have to buy hay in preparation for winter.

Farming enterprises which are able to access water sources freely or at a low cost may also specialise in crop farming, for example in hay production, which they sell to other livestock farms.

Women interviewed by ERM shared that there are generational differences in the extent to which women contribute to their household income. While respondents estimated that 90% of women of working age are in employment, for families over the age of 50, respondents estimated that women contribute to only 30% of the household income. In comparison, for women below 35, they estimated that women contribute to 60-70% of the household income. In contrast to

[291] One respondent was excluded here as he declined to answer this question.

regional statistics on women's employment in the agricultural sector, ERM's site findings suggest parallel to the regional statistics, the agricultural sector is fairly gender-balanced and women are primarily involved in livestock and crop production as milkmaids, accountants, selling produce in the market and as cooks.

7.4 DEFINITION OF THE SOCIAL AREA OF INFLUENCE

The Social Area of Influence (SAoI) has been identified as the area with a presence of social receptors that are likely to be affected by the Project activities, first, due to the procurement of land in the planning or pre-construction phase and then, during the construction and operation of the Project. According to information made available to ERM, as of December 2024, the construction is currently estimated to last approximately two (2) years, and the operational phase of the project has not been limited in time. The SAoI is based on the project footprint described in **Section 2.** A summary of the project components or requirements as well as the associated potential social impacts is presented in **Table 7-30.**

TABLE 7-30: KEY PROJECT COMPONENTS AND POTENTIAL SOCIAL IMPACTS

Project Component/ Requirement	Resource Required	Potential Impacts
• **Construction Phase**		
Land acquisition	284 land plots[292], over 10,564,300 m^2 (permanent land acquisition)	• Economic displacement of affected landowners and users. • Potential loss of income and livelihoods for those reliant on land-based activities (agriculture, grazing). • Loss of access to land due to fragmentation caused by the Project's land procurement. • Physical displacement, especially around Zhetygen Station.
Construction of railway stations and rail alignment, along with civil structures	• Kazybek Bek: 54,800 m^2 • Zhetygen: 90,000 m^2 • Sorbulak: 40,800 m^2 • Moyinkum: 30,300 m^2 • Zhana Arna: 47,000 m^2 • 75km new track • One (1) temporary road overpass • Seven (7) metal bridges • Five (5) railway or highway overpasses • Six (6) reinforced concrete bridges	• Increased traffic and congestion. • Risk of impacts to pedestrian safety due to increased traffic from construction activity • Occupational health and safety risks for construction workers. • Temporary noise and dust pollution impacting nearby residents. • Strain on local infrastructure and services from increased number of construction workers in the area. • Increased noise and vibration levels from construction equipment.

[292] The figures represent the permanent land acquisition of 284 land plots across five districts, with approximately 10.5643 km^2 (1,056.43 hectares) based on 6 Decrees issued between May 2023 – March 2024 by the District Akimats of Karsay, Zhambyl, Talgar and Iliy. The decree for Alatau City has not yet been released, but the figure is the expected additional permanent land requirements in Zhetygen station based of consultations with KTZ and Alatau City Land Department as of January 2025 (the 10 new additional land plots). This is expected to increase with the temporary land requirements of quarries (please refer to the rows below in this table for temporary land requirements for quarries).

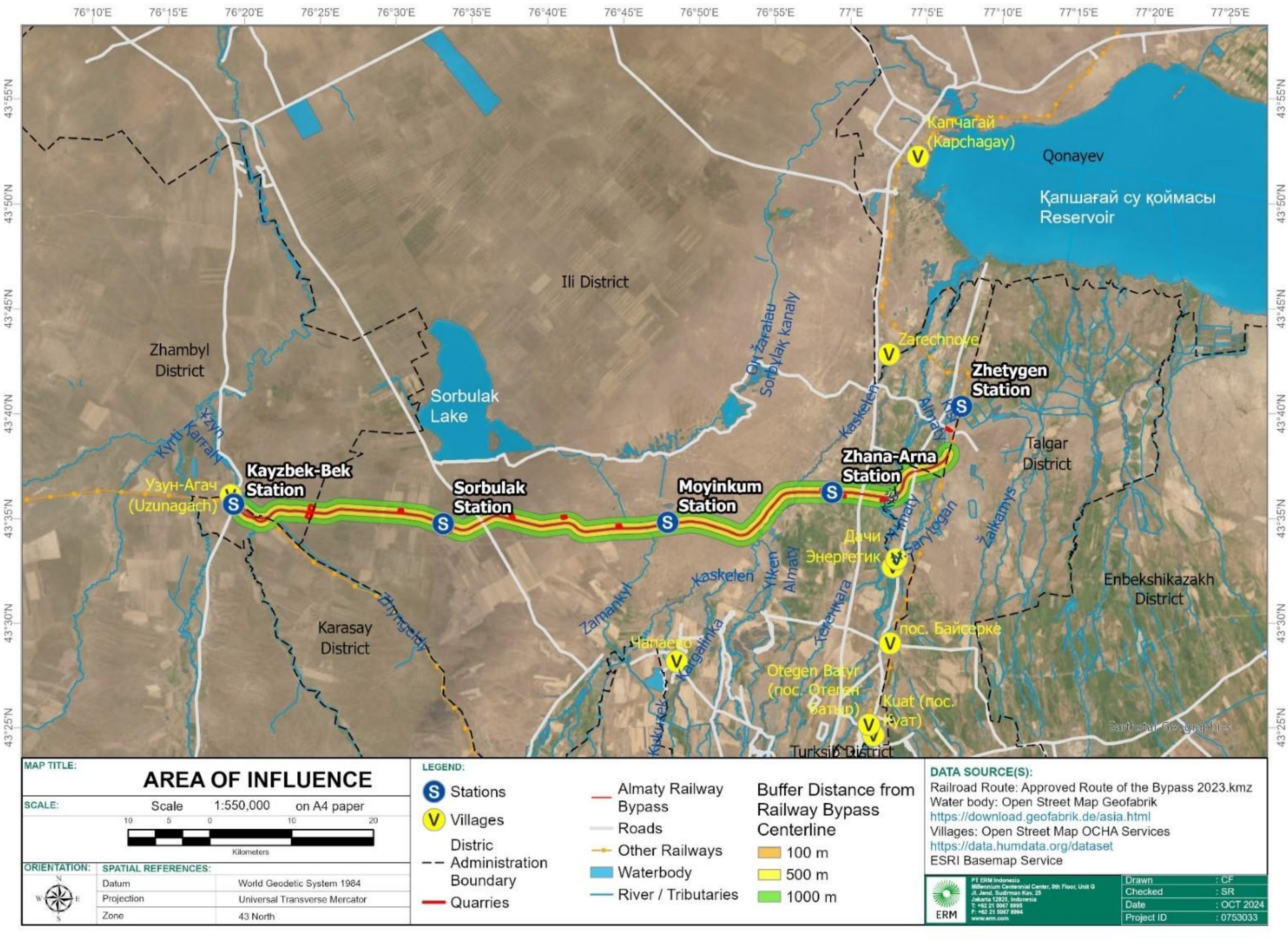
Project Component/ Requirement	Resource Required	Potential Impacts
	• 59 drainage culverts [293]	• Risk of impacts on livestock due to construction activity including traffic movement.
Quarries supplying construction material	• 14 Quarries[294] estimated at 1.8094 km^2 (temporary land procurement during the construction phase from land provided by the Akimats): • 4 quarries (0.5706 km^2) are partially intersecting the RoW: no.s 4, 7A, and 14A, 16 • 10 quarries (1.2388 km^2) are outside of the RoW: no. 2, 3, 5, 6, 7, 8, 9, 20A, 20B and 30 • RoW (varying between 50m along the alignment to 500m at the railway stations).	
Labour accommodation	Two (2) camps at Sorbulak and Zhana Arna stations[295]	• Increased truck traffic leading to road safety concerns • Risks of child labour or unethical labour practices if not managed properly • Increased availability of jobs due to direct and indirect economic opportunities • Change in community dynamics; risk of exacerbating gender-based violence and/or increased social tensions
Labour force	• Approximately 1,500 workers for construction; • Approximately 500 workers for operation	
Water supply	Utilisation of local groundwater for construction needs; Potable water	Scoped out; there are limited impacts to groundwater due to the small amount expected to be withdrawn.
Operations Phase		
Level crossings (Railway line and vehicular/pedestrian flow on roads)	• Operations of 27 freight trains per day for each direction; total 54 trains in both directions per day.	• Safety risk to pedestrians and vehicles at level crossings. •

[293] The National EIA stated that there are 48 culverts. Clarifications with Poligram in January 2025 confirmed that there are 59 culverts.
[294] The 14 quarries are located in Zhambyl District (No20 A, No2 and No3), Iliy District (No4, No5, No6, No7, No7 A, No8 and No9) and on the lands of administrative-territorial subordination of the City of Alatau (No14, No16, No20 B and No30). While temporary land procurement may be in the construction phase, the permanent land acquisition is shown in the pre-construction or planning phase of the project.
[295] ERM was able to obtain information regarding two (2) labour camps, and an assessment of these is being used to extrapolate impacts should there be more labour camps at the time of peak construction.

Project Component/ Requirement	Resource Required	Potential Impacts
Railway operations, especially along inhabited stretches		• Noise and vibrations from operations, especially for houses close to the stations[296].

Considering the likely potential social impacts due to an important transport infrastructure project will not be confined to just the settlements along the right of way (RoW), the Project's SAoI for the Supplementary ESIA has been defined as the Zhambyl District, the Iliy District, the Karasay District, Alatau City and the Talgar District within the Almaty Region in Kazakhstan.

TABLE 7-31: SOCIAL AREA OF INFLUENCE



7.4.1 SETTLEMENTS LOCATED WITHIN THE SAOI

According to information received by ERM, a total of 284 land plots[297] were identified to have been affected across the districts of Talgar, Zhambyl, Iliy, Karasay and Alatau City (**Table 7-32**).

[296] At the time of writing, as of February 2025, the train schedule is yet to be finalised. The noise and vibration impact are expected to be heightened when the train is passing stretches of the alignment which are in close proximity (100m) to residential receptors and/or settlements.

[297] 284 land plots across 1,056.43 hectares. The initial figure prior to the addition 10 land plots from Alatau City was 274 land plots across 1,033.08 hectares. The figure represents permanent land acquisition based on 6 Decrees issued between May 2023 – March 2024 by the District Akimats of Karsay, Zhambyl, Talgar and Iliy. The decree from Alatau City has not yet been released, at the time of writing.

ERM noted that there are discrepancies in the location of the land plots as derived from the cadastral numbers and the addresses provided (collated in Annex 5 of the IFC PS5 Gap Analysis Report). ERM was not able to obtain an up-to-date land use map from the District Akimats engaged, including Karasay, Zhambyl, Iliy and Talgar.

TABLE 7-32: SETTLEMENTS LOCATED WITHIN THE SAOI

District	Rural District	Settlement[298]	No. of Land Plots Affected
Alatau City	Zhetygen	Enbek	1
		Mezhdurechensk	1
		Zhana Arna	1
		Mezhdurechensk	1
		Zhetygen[299]	23
	s.o. Mezhdurechensky	Mezhdurechensk	3
		Baiserke	1
	Ashibulakskiy	Mukhametzhan Tuymebayev	2
		Ashibulak	1
	Baiserkinsky	Baiserke	2
	Energeticheskiy	Pokrovka	1
		Otegen Batyr	1
	s.o. Kainarsky	Data gap	5
	s.o. Nurinsky	Nura	1
	Data gap	Data gap	5
Iliy	Ashibulakskiy	Mukhametzhan Tuymebayev	4
		Karaoi	1
	Baiserkinsky	Baiserke	10
		Data gap	1
	Energeticheskiy	Otegen Batyr	2
	Karaoisky	Karaoi	17
		Kazcik	1
		Kosozen	1
		Nargisa Tilendiev	6
		Data gap	9
	Kurtinskiy	Akshi	6
		Data gap	2
	Kaztsik	Kazcik	1

[298] The settlements presented here may refer to villages, towns or microdistricts. It refers to whichever is the lowest administrative unit. for a glossary of administrative terms.
[299] Established in January 2024 as the city of Alatau in the Almaty region.

District	Rural District	Settlement[298]	No. of Land Plots Affected
	Data gap	Data gap	3
	s.o. Mezhdurechensky	Mezhdurechensk	19
		Data gap	7
Karasay	Zhanashamalgan	Kazybek Bek	2
		Zhibek Zholy	1
	s.o. Zhibek Zholy	Zhibek Zholy	3
	s.o. Irgelinsky	Kemertogan	2
	Eltai	Eltai	1
		Koktogan	1
	Karasai	Zhyngyldy	1
	Data gap	Data gap	2
Talgar	s.o. Kainarsky	Data gap	30
	s.o. Nurinsky	Nura	9
	Data gap	Data gap	16
Zhambyl	Termizhol	Kazybek Bek	18
		Data gap	9
	Zhambyl	Uzynagash	1
	Aksengirsky	st. Zhiren-Aygyr	1
	Data gap	Data gap	16

Source: IFC PS5 Gap Analysis Report, https://map.gov4c.kz/egkn/, List of 49 land plots around Zhetygen station as issued by KTZ

7.5 ASSESSMENT OF SOCIAL AND SOCIO-ECONOMIC IMPACTS OF THE PROJECT

This section presents an assessment of social impacts resulting from Project requirements (land and natural resources) and Project activities. The impact assessment method is described in **Section 5.**

ERM conducted a rapid scoping exercise as part of the rapid reconnaissance report submitted to the client on 17 October 2024[300]. The identified potential impacts, along with the Gap Analysis Report prepared for IFC by their consultant (on land acquisition for the Project) formed the basis of the social baseline study and impact assessment.

The social impact assessment seeks to assess the potential social impacts from Project-related requirements and activities on sensitive receptors.

As part of the impact assessment process, the vulnerability of receptors has been considered as part of 'sensitivity'. It is highlighted that the precautionary principle has been applied in undertaking the assessment, including when considering vulnerability.

[300] First draft submitted on 17 October 2024; final version submitted on 15 November 2024.

7.5.1 AVOIDANCE AND OPTIMISATION OF PROJECT FOOTPRINT

According to information made available to ERM, the design of the Project has taken into consideration five (5) different options in relation to the rail alignment. **Section 2.5.2** describes the five (5) options considered in detail. The final alignment decision included considerations of community impacts such as

- Minimisation of disruption to agricultural land
- Avoidance of residential structures to the extent feasible (with some impacts likely around the existing Zhetygen and Kazybek Bek stations)
- Minimisation of earthworks; and
- Alignment with Almaty's General Plan for Suburban Zones to avoid impacts on planned urban expansion or land use policies.

Considerations on the avoidance of physical displacement along the alignment of the RoW. **Figure 7-13** highlights these examples.

FIGURE 7-13: AVOIDANCE OF POTENTIAL PHYSICAL DISPLACEMENT (SITE SURVEY)

Satellite Imagery	
Avoidance of Physical Displacement No. 2	
 Date: 05/2021	 Date: 12/2024 (latest)
 Farmland with a residential structure and barn. Facing South-East with the Bypass to the left of the structures. The structures are approximately 215m from the centreline of the Bypass and 75m from the edge of the RoW.	 Water pump facility on the land plot. Facing West with the Bypass behind the water pump. The water pump is approximately 130m from the centreline and 27m from the edge of the RoW.
Coordinates: 43°35'8.00"N, 76°21'53.00"E	
Avoidance of Physical Displacement No. 3	

Satellite Imagery

Date: 05/2021

Date: 12/2024 (latest)

Facing South where a family household with children were residing. The land plot had seven (7) structures in total, including various structures for agriculture use. The house is approximately 290m from the centreline and 262m from the edge of the RoW.

Facing North, with the Bypass in the backdrop behind the barns and structures for agriculture. The closest structure is approximately 35m from the centreline and 10m from the edge of the RoW.

Coordinates: 43°35'10.80"N, 76°24'59.20"E

Avoidance of Physical Displacement No. 5

Date: 05/2021

Date: 07/2023 (latest)

Satellite Imagery

Facing South with the Bypass behind the structure. A family household lives here. This residential structure is approximately 192m from the centreline and 23m from the edge of the RoW. The land plot has at least three (3) other agricultural structures.

Facing North away from the Bypass (the Bypass is behind from where this photo was taken). The agricultural barn is approximately 290m from the centreline and 110m from the edge of the RoW.

Coordinates: 43°34'48.24"N, 76°39'10.85"E

Avoidance of Physical Displacement No. 11

Date: 04/2021

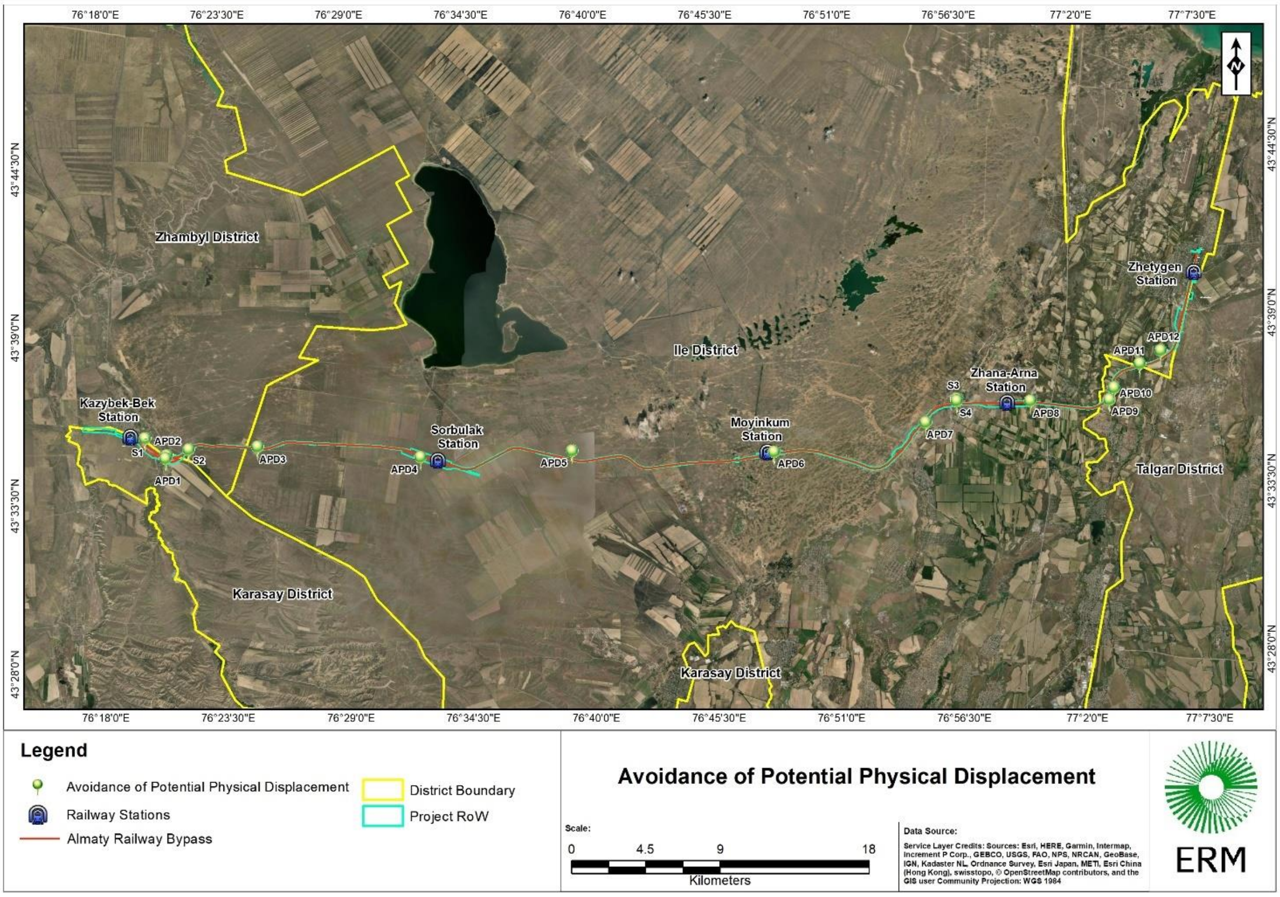
Date: 05/2023 (latest)

Facing South away from the Bypass (the Bypass is behind from where this photo was taken). A Family of three (parents and a child) live here all year round. They are engaged in agriculture, do not have access to electricity and bring water from another place.

Structures that support their livelihoods are 20m from the edge of the RoW.

Satellite Imagery	
The residential structure is 80m from the centreline and 45m from the edge of the RoW.	
Coordinates: 43°37'17.44"N, 77° 4'42.71"E	
All photos taken during site visit between 28 October – 8 November 2024. Satellite Imagery Map Sources: GoogleEarth	

FIGURE 7-14: AVOIDANCE OF POTENTIAL PHYSICAL DISPLACEMENT (MAP)



The land being considered for the Project across the districts of Alatau City[301], Talgar District, Zhambyl District, Karasay District and Iliy District is presented in **Table 7-33**.

TABLE 7-33: PROJECT LAND REQUIREMENT BY OWNERSHIP AND DISTRICTS

District	No. of Private Land Plots	No. of State-Owned Plots	Total No. of Plots	Affected Land Area (Ha)
Alatau City	40 (23.95%)	9 (7.69%)	49 (17.25%)	83.73 (7.93%)
Iliy	75 (44.91%)	65 (55.56%)	140 (49.30%)	850.51 (80.50%)
Karasay	4 (2.40%)	9 (7.69%)	13 (4.58%)	39.55 (3.74%)

[301] Alatau City was established in January 2024, formed by Zhetygen village (previously part of Iliy District), parts of Talgar district and other settlements in the region. As the land acquisition process began prior to the establishment of Alatau City, and the establishment of Alatau City is still in progress, this Supplmentary ESIA will refer to affected land plots from Alatau as part of Iliy and Talgar Districts, unless alternative information is made available.

District	No. of Private Land Plots	No. of State-Owned Plots	Total No. of Plots	Affected Land Area (Ha)
Talgar	41 (24.55%)	7 (5.98%)	48 (16.90%)	38.99 (3.69%)
Zhambyl	7 (4.19%)	27 (23.08%)	34 (11.97%)	43.71 (4.14%)
Total	**167**	**117**	**284**	**1056.49**

Table 7-34 summarises the potential social impacts considered in the assessment during the pre-construction or planning phase, the construction phase and the operations phase of the Project. The assessment of each social is presented in detail in the subsequent subsections.

TABLE 7-34: SUMMARY OF POTENTIAL SOCIAL IMPACTS

Project Phase	Activities	Potential Social Impacts	Receptors
Pre-construction or Planning	Land procurement for the construction of the railway tracks, stations, and the 1.961 km overhead transmission line between the Project and the PS Alma-500 substation. that includes acquisition of private land, leased land and procurement of government land.	• Physical and economic displacement resulting from the land acquisition • Disruption of household and community activities • In some cases, increased household vulnerability due to resettlement processes. • Access disruption and, income and livelihood impacts due to land fragmentation and inaccessibility of land plots, in particular cases, where alternate access is not provided. • Income and livelihood impacts to land owners left with unviable pieces of land after the land acquisition • Temporary loss of income for land lease holders, tenant farmers and workers who are affected by land acquisition	• Landowners, • Land users (including land lessees, tenant farmers) and • Workers All the above, on the land acquired for the Project footprint and outside of the RoW, the land required to construct the transmission line.
	Land procurement for the construction of quarries to supply material for the construction phase from district Akimats.	None identified[302]	

[302] KTZ has clarified that all quarries outside the Project RoW used for the Project are on government land. The presence of land users previously leasing land from district Akimats at these quarry locations remains unconfirmed. However, based on site observations, it is unlikely that there were land users who had to be displaced for the Project. While some grazing activity was noted around the quarries, this is common across Kazakhstan and does not necessarily indicate formal land use.

Project Phase	Activities	Potential Social Impacts	Receptors
Construction	Construction of railway tracks, stations and other project components and associated facilities[303].	*Positive Economic and Employment Impacts* • Direct employment in construction. • Economic opportunities created through local procurement. • Capacity building for local construction workers, subcontractors and suppliers. • Indirect employment and economic opportunities created through presence of workers. *Community Health and Safety (including gender-based risks)* • Nuisance due to construction dust and noise- potentially affecting the resident population, agricultural fields and livestock (especially those grazing in the vicinity of the construction works). • Increased risk of traffic accidents, loss of livestock and loss of life due to construction vehicles. • Construction vehicles causing damage to land when used as access roads. • Presence of security personnel leading to risk of conflict with the local communities • Increased risk of Sexual exploitation and abuse (SEA) and Gender based violence and harassment (GBVH), especially among the young and women, from the local communities. • Public and social infrastructure strain.	*Positive Impacts:* • Owners and employees in construction and relevant industries, businesses and enterprises, local to the area and in the larger context, Kazakhstan. *Positive and Negative Impacts/Risks:* • Sensitive receptors in the vicinity of the Project e.g. livestock owners, cultivators and residents, who will be subject to noise, dust, nuisance impacts, • The above may also apply to livestock (open grazing) in the vicinity of the construction operations • Gender-differentiated risks and impacts for young girls, women in terms of safety

[303] No information on associated facilities have been received by ERM at the time of writing (18 December 2024). Associated facilities are expected to be commissioned in 2025 according to the OPZ provided by Poligram. An assessment of the impacts of associated facilities will need to be conducted when information is made available.

Project Phase	Activities	Potential Social Impacts	Receptors
		• Disease spread due to influx of labour force from outside *Labour and working conditions* • Occupational health and safety risks for workers. • Accommodation and living conditions on site.	
Operations	Operations of the Almaty bypass connecting the Almaty-1-Chu railway line at Kazybek Bek station to the Almaty-1-Aktogay line at Zhetygen station as part of the Altyn-Khorgos border crossing railway route.	*Positive Economic and Employment Impacts* • Opportunities for direct employment in railway operations. • Indirect opportunities created through opportunities created by rail activity e.g. small businesses. • National and regional economic growth due to increased freight volume and associated government revenue through taxation. • Increased accessibility for passenger and cargo transport. *Community Health and Safety* • Increased risk of traffic accidents, loss of livestock and loss of life due to increased rail activity and traffic, especially at level crossings. *Labour and working conditions* • Occupational health and safety risks for workers. *Noise and vibration impact on residents living in the vicinity of stations and the alignment* • Noise emissions from rail projects can lead to disturbance, sleep disruption, stress, and reduced quality of life for nearby residents. • Rail-induced ground-borne vibrations can cause discomfort,	• Population in the Talgar, Iliy, Alatau, Zhambyl and Karasay districts. • Population in the Almaty region. • Workers employed in the rail operations.

Project Phase	Activities	Potential Social Impacts	Receptors
		structural damage to buildings, and disruption to sensitive facilities such as residential settlements, based on proximity.	

7.6 ASSESSMENT OF IMPACTS IN THE PRE-CONSTRUCTION OR PLANNING PHASE

As mentioned, the social impacts of the Project in the Pre-Construction or Planning Phase mainly relate to land procurement for the Project components and quarries for construction. In particular, the following sections describe involuntary resettlement impacts in this phase of the Project due to physical and economic displacement and considers the varying impacts on landowners, leaseholders or tenants (categorised as land users), commercial entities, workers on the impacted lands, and communities living in the vicinity of the alignment using communal grazing areas. **Table 7-35** summarises the involuntary resettlement impacts which are explored in detail in the relevant subsections.

As of January 2025, the information received by ERM indicates that 64 out of 167 (38.32%) privately-owned land plots and 44 out of 117 state-owned land plots (37.61%) have been procured by the Project[304]. This Supplementary ESIA will be assessing the impacts of the land acquisition retrospectively for lands which have already been procured.

State-mandated compensation will be assessed as an embedded control or mitigation and the significance of the residual risk/ impacts will be used to assess the additional mitigation required, as relevant. This is included in the later sub-sections after the table, which presents as assessment of impacts prior to mitigation (compensation).

[304] The remaining 38 land plots were state-owned land which had already been transferred to KTZ's ownership.

TABLE 7-35: SUMMARY OF INVOLUNTARY RESETTLEMENT IMPACTS

Affected Entity	Extent of Land Acquisition	Livelihood Dependency	Description of Key Impacts	Type of Displacement	Approximate No. of Project-Affected Households/Entities
Landowner	Partially acquired	Land-based	Landowner loses their land and, income and livelihoods are affected.	Economic displacement	120 to 140 households
		Not land-based	Landowner loses their land. Partial impacts to income; livelihoods are not affected.	Limited adverse economic displacement	10 to 15 households
	Entirely acquired	Land-based	Landowner partially loses their land and livelihood. May suffer from additional livelihood impacts due to loss of access to other lands, land fragmentation, or being left with an unviable piece of land after the land acquisition.	Economic displacement	25 to 35 households
		Not land-based	Landowner partially loses their land and may have the same situation as above, regarding access, fragmentation and unviable land. However, impacts only on income and minimal livelihood impacts.	Limited adverse economic displacement	4 to 10 households
	In-use residential structure affected by land acquisition and noise impacts	Land-based or not land-based (refer to above)	Loss of primary residence (may or may not be combined with economic displacement impacts, depending on whether their land is also affected, and their livelihoods are land based)	Physical displacement, may be accompanied by economic displacement	13 to 15 households
User (Tenant/ Lease holder)	Partial loss of access	Land-based	Land user loses the use of the land; income and livelihoods are affected.	Economic displacement	30 to 50 households
		Not land-based	Land user loses the use of their land. Partial impacts to income; livelihoods are not affected.	Limited adverse economic displacement	6 to 10 households
	Complete loss of access	Land-based	Land user partially loses the use of their land. May suffer from additional livelihood impacts due to loss of access to other lands, land fragmentation, or being left with an	Economic displacement	5 to 10 households

Affected Entity	Extent of Land Acquisition	Livelihood Dependency	Description of Key Impacts	Type of Displacement	Approximate No. of Project-Affected Households/Entities
			unviable piece of land after the land acquisition.		
		Not land-based	Land user loses the use of their land. Partial impacts to income; livelihoods are not affected.	Limited adverse economic displacement	2 to 10 households
	In-use residential structure affected by loss of access to land	Land-based or not land-based (refer to above)	Loss of primary residence (may or may not be combined with economic displacement impacts, depending on whether their land is also affected and their livelihoods are land based).	Physical displacement, may be accompanied by economic displacement	1 to 5 households.
Commercial Entities that owned the land	Partially acquired	Land-based	Loss of productive land and potential loss of revenue from commercial operation.	Economic displacement	8 to 10 commercial entities
	Entirely acquired	Land-based	Fragmentation of land could render remaining portions unviable for commercial operations, resulting in potential revenue loss.	Limited adverse economic displacement	0 (None identified)
Commercial Entities that used the land	Partial loss of access	Land-based	Loss of access to leased land, impacting commercial activities such as agriculture, logistics, or other operations.	Economic displacement	9 to 12 commercial entities
	Complete loss of access	Land-based	Reduced access to portions of leased land, leading to reduced productivity and economic viability.	Limited adverse economic displacement	1 to 5 commercial entities
Workers on the land that is acquired	Full or partial, but resulting in loss of employment for the worker	Land-based	Temporary loss of income and/or livelihood, for the duration of the impact, until alternate employment is found	Economic displacement	20 to 100 workers
Local communities in settlements along the alignment	Partial loss of grazing areas that are owned by the State and/or Akimats	Land-based	Loss of communal grazing areas could impact local livestock-rearing activities, which are crucial to household economies in rural areas	Economic displacement	15 to 30 settlements

7.6.1 PHYSICAL DISPLACEMENT OF LANDOWNERS AND USERS

Although initial assessments suggested minimal physical displacement, updated Project boundaries and land requirement included residential structures. It was confirmed during the site visit and through interviews that some affected households had already vacated their properties, while others remain occupied pending compensation and relocation processes.

Physical displacement associated with the Project primarily affects households and structures in the vicinity of Zhetygen Station, where land acquisition for the Project Right-of-Way (RoW) has been identified. KTZ confirmed that there are no residential structures near Kazybek Bek Station that will be affected by the Project's land acquisition. Hence, as agreed with the client, Kazybek Bek was excluded from this assessment.

While the Project boundary for Zhetygen has yet to be finalised, an assessment was made based on site surveys and consultations conducted with the Alatau City Land Department. 13 residential structures have been identified for acquisition, affecting an estimated 13 to 15 households. Additionally, nine (9) non-residential structures, including barns and small shops, have also been marked for removal. Due to the lack of confirmed Project boundaries, the identification was based a visual assessment and enumeration of affected structures, which according to the Alatau Land Department Representative had been marked by KTZ in red paint.

Some respondents were uncertain whether their structures would be affected, despite visible red markings placed by the authorities for the purpose of identifying affected structures. The total number of land plots affected in this area is 49, based on the latest information received from KTZ (end January 2025). There is no confirmed information yet on the number of land plots of which acquisition would lead to physical displacement in the records of the Alatau Land Department, as the Department is newly established and the process of land acquisition has just started for this portion of land.

- 10 structures are yet to be moved.
- Three (3) structures have already been vacated.
- Neighbours informed ERM that two (2) out of the 13 residential structures are occupied by tenants. The remaining surveyed structures are assumed to be privately owned by landowners.

7.6.1.1 POTENTIAL AND/OR EXISTING IMPACTS

The primary impacts of physical displacement for affected households including concerns expressed by potentially affected stakeholders are below:

Loss of Residential Property and Assets

- Households permanently lose access to their homes and must secure alternative housing.
- Compensation processes, while aligned with national land acquisition regulations, affected households are concerned regarding the adequacy of the compensation for purchasing comparable replacement homes.
- Other concerns expressed by potentially affected stakeholders were that additional affected structures such as fences, trees, and small business assets (e.g., home-based shops) may not be fully covered in the valuation processes.

Economic and Social Disruptions

- Households reliant on local employment, markets, or support networks may face disruptions to livelihoods and community ties.
- Elderly residents and vulnerable groups (e.g., single female-headed households) may struggle with relocation logistics and rebuilding their living conditions.

Unclear Project Boundaries

- Several respondents indicated confusion about the exact extent of land acquisition, making it difficult to plan for alternative housing.
- Land fragmentation may result in certain parcels becoming inaccessible or unusable for former residents.

7.6.1.2 EMBEDDED CONTROLS

The Project's embedded controls for physical displacement are primarily designed to ensure compliance with Kazakhstan's national legislation on land expropriation for state-needs. These regulations govern the acquisition of land and compensation for affected households, including those experiencing physical displacement due to residential structure acquisition.

Many of the controls described below also apply to economic displacement (see **Section 7.6.3 to Section 7.6.4**), as land acquisition affects both residential and economic landowners. However, specific considerations for physically displaced households, including housing replacement and relocation support, are further detailed in this section.

While some alignment exists with IFC Performance Standard 5 (PS5), the primary framework guiding land procurement and compensation remains Kazakhstan's Land Code and related national expropriation laws. For further details on the land acquisition process in Kazakhstan and its gaps in relation to IFC PS5, please refer to the Livelihood Restoration Plan and the Resettlement Framework.

Avoidance of Impacts Through Alignment Optimisation

To minimise displacement impacts, the Project alignment was selected based on an optimisation process that considered five different route options. This process aimed to:

- Avoid densely populated areas to reduce the number of physically displaced households.
- Minimise disruption to local settlements and economic activities by prioritising alignment through less inhabited zones.
- Limit land acquisition requirements to the extent feasible, ensuring that only essential areas are affected.

Compliance with Kazakhstan's National Expropriation Laws

The process for land acquisition follows the standard legal framework, which includes:

- Issuance of an expropriation decree and public notification of affected landowners.
- Valuation of affected land and assets by state-licensed valuators engaged by District Akimats.

Provision of Compensation in Accordance with National Regulations

Physically displaced landowners are compensated for the loss of their residential structures based on valuations conducted by state-licensed appraisers.

Compensation mechanisms include either:

- A replacement land plot (where applicable), or
- Monetary compensation equivalent to the assessed value of the affected land and assets.

According to the Land Department representatives interviewed, a replacement land plot of comparable value and characteristics will be provided if the landowner asks for it, and if the specific land plot is available. In practice, however, replacement land plots can be difficult to find and monetary compensation is more commonly disbursed.

Monetary compensation is determined based on:

- Standardised base rates from Kazakhstan's cadastre system, considering land use, soil characteristics, geographic region, and infrastructure development.
- Valuation of fixed assets, including residential structures, fences, and productive trees.
- Adjustment coefficients reflecting physical condition, location, and market demand.
- Negotiation and finalisation of compensation agreements before relocation requirements take effect.

Notification and Relocation Process

- Affected landowners have been notified through official decrees, written notices, and direct communication from Akimats and KTZ representatives.
- In accordance with national laws, physically displaced households must vacate their properties only after compensation has been paid.
- Unless otherwise agreed with the Akimat, the earliest at which a landowner or tenant can be evicted would be three (3) months from the publication of the Decree on state expropriation.
- In some cases, affected households have been granted extended occupancy rights by District Akimats to allow for smoother transitions.

7.6.1.3 ASSESSMENT OF IMPACT SIGNIFICANCE

Impact Magnitude: Medium

- **Permanent loss of housing:** While there are 13 residential structures assessed to be marked for acquisition, they represent irreversible physical displacement for the affected households.
- **Risk of increased displacement:** There is a risk that the scale of physical displacement impacts may increase as the Project boundaries are yet to be finalised, and that the noise-affected houses present a potential additional displacement risk.
- **Exclusion of unregistered residents and assets:** Per the national legislation in Kazakhstan, land use, assets and persons unregistered with the Land Department are not formally recognised and will not be entitled to any compensation nor engaged with in the land acquisition process. These persons (if any are identified) will face disproportionate displacement impacts as the embedded controls do not apply to them. Two (2) SSI respondents shared that they have income-generating assets on their residential land which would be impacted by the land acquisition, but would not be recognised as such as they had not been registered as commercial assets, and will therefore not quality for compensation.

Receptor Sensitivity: Medium

- **Vulnerable populations affected:** Households include elderly residents, single female-headed households, and households with persons with disabilities, increasing their vulnerability to displacement stress. Affected families rely on local economic and social networks, making relocation more disruptive. A key concern for residents likely to be displaced was their ability to find replacement housing in proximity to schools (for households with children of school-going age).
- **Compensation concerns:** Compensation follows Kazakhstan's national expropriation laws, but semi-structured interviews suggest concerns about whether compensation is sufficient for acquiring alternative housing in the same district. No formal resettlement assistance beyond compensation is currently planned. Of the respondents who had been resettled, one (1) indicated that he/she had incurred transaction costs beyond the compensated amount, for the replacement house. Additionally, respondents indicated that the compensation received will likely exclude transaction costs such as payments for notary services, intermediaries, and other costs for transportation, moving etc, among others.

Impact Significance: Moderate

- The impact significance is assessed as moderate due to the combination of medium impact magnitude and medium receptor sensitivity.
- This assessment reflects the significance of physical displacement impacts on affected households, especially given the irreversible nature of land acquisition and the lack of adequate safeguards for physically displaced households in the process, though this is somewhat mitigated by the relatively small number of households facing physical displacement.

7.6.1.4 MITIGATION MEASURES

The mitigation measures proposed aim to address gaps in compensation, resettlement assistance, and monitoring, as identified in the gap assessment against IFC PS5. While detailed measures and corrective actions are outlined in the Resettlement Framework, this section highlights key mitigation strategies to minimise adverse social impacts on physically displaced households.

- **Ensuring Compensation Reflects Full Replacement Cost**
  - Provide additional financial support to cover transaction fees, relocation costs, and any gaps in state-determined compensation.
  - Engage an independent valuator to verify whether compensation is sufficient for securing comparable housing.
  - Where discrepancies exist, top-up payments will be made to ensure compensation meets market value.
- **Compensation and Assistance for Informal/Unregistered Occupants:**
  - In cases for which unregistered occupants are found to be physically displaced, engage with the Akimat and Land Department to waive fines where possible.
  - Provide relocation and moving assistance to ensure they are not left without housing.

- Assist in identifying alternative housing with legal tenure if required.

- **Resettlement Assistance for Vulnerable Groups:**
    - Per the guidance set out in the Resettlement Framework, to implement a targeted resettlement assistance program for elderly residents with limited mobility, single female-headed households, households with disabled members and lower-income households (if identified).
    - This includes assistance to search and secure alternate, comparable homes, additional transitional assistance (if necessary) to cover unexpected relocation expenses and ensuring that households with disabled members have access to suitable housing.
- **Strengthening Consultation and Grievance Redressal:**
    - Ensure timely and clear communication with affected households on compensation, resettlement options, and project impacts.
    - Establish a Project-Level Grievance Redress Mechanism (GRM) to resolve disputes efficiently and transparently.
- **Implementing Post-Resettlement Monitoring:**
    - Conduct a 2-year monitoring program to assess whether displaced households have secured adequate housing and restored livelihoods.
    - Address any unresolved compensation or relocation issues that arise post-resettlement.

7.6.1.5 SUMMARY

With these measures in place, the impact significance can be revised to **Minor.**

TABLE 7-36: IMPACT SIGNIFICANCE OF PHYSICAL DISPLACEMENT OF LANDOWNERS AND USERS

Impact Significance on Physical Displacement on Landowners and Tenants					
Potential Impact	Physical displacement impacts on landowners and tenants due to Project's land requirements.				
Project Phase	**Pre-construction**	Construction	Operation		
Impact Nature	**Negative**	Positive	Neutral		
Impact Type	**Direct**	Indirect	Induced		
Impact Duration	Temporary	Short-term	**Long-term**	**Permanent**	
Impact Extent	**Local**	Regional	International		
Impact Scale	The impact is limited to the households residing within the Project footprint. 13 residential structures representing about 13 to 15 households will be affected.				
Frequency	The impact will only occur once: permanent acquisition of the land for the purposes of the Project will only occur once for the area required.				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Receptor Sensitivity	Low	**Medium**	High		

Impact Significance on Physical Displacement on Landowners and Tenants					
Impact Significance	Negligible	Minor	**Moderate**	Major	
Residual Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Residual Receptor Sensitivity	**Low**	Medium	High		
Residual Impact Significance	Positive	Negligible	**Minor**	Moderate	Major

7.6.2 ECONOMIC DISPLACEMENT OF LANDOWNERS

Private land plots make up a significant proportion of the Project-affected land plots by number (57.03%) and impacted area (68.25%). These private plots are primarily used for peasant farming, commercial agriculture, or other undefined activities.

Economic displacement will occur (or has occurred) for the private landowners whose land parcels will be (or has been) acquired for Project-related activities, especially for households directly dependent on their lands for their livelihoods. In total, 136 privately owned plots are partially acquired, while 28 are entirely acquired, as described in **Table 7-37**.

This analysis assesses the impacts based on landowner categories, considering whether they depend on land-based livelihoods and the extent of land acquisition (entire or partial).

The landowners generally:

- Comprise individuals or families owning land for various purposes, including peasant farming, small-scale agriculture, and residential or mixed-use activities.
- Are impacted by both entire and partial acquisition, with significant consequences for those dependent on land-based livelihoods.
- Vulnerable groups within this category, such as women-headed households and elderly landowners, face heightened challenges due to limited adaptability and dependence on local resources.

Table 7-37 further describes the different categories of landowners assessed in this section and the extent of land acquisition in each category.

TABLE 7-37: PRIVATE LANDOWNER CATEGORIES

Category		**Proportion of land impacted (%)**											**Total**
		0-10%	**>10-20%**	**>20-30%**	**>30-40%**	**>40-50%**	**>50-60%**	**>60-70%**	**>70-80%**	**>80-90%**	**>90-100%**	**Data Gap**	
Dependent on land-based livelihoods	No. of plots	52	22	16	8	9	2	3	3	3	24	3	145
	Proportion of total (%)	36%	15%	11%	6%	6%	1%	2%	2%	2%	17%	2%	100%
Not dependent on land-based livelihoods	No. of plots	6	3	1	0	0	0	0	0	0	4	0	14
	Proportion of total (%)	43%	21%	7%	0%						29%	0%	100%

Note: this analysis is based on the assumption that land use for peasant farming indicates a dependency on land-based livelihoods while landowners indicating use for other purposes are not dependent on land-based livelihoods.

7.6.2.1 POTENTIAL AND/OR EXISTING IMPACTS

For landowners whose lands are entirely acquired, and who are dependent on land-based livelihoods, the potential and/or existing impacts include:

- Economic displacement due to permanent loss of livelihood sources.
- Difficulty transitioning to alternative livelihoods, especially for households with limited skills or financial resources.
- Vulnerable groups, such as female-headed households or elderly landowners, face heightened challenges in rebuilding their livelihoods.

For landowners whose lands are entirely acquired, and who are not dependent on land-based livelihoods, the potential and/or existing impacts include:

- Limited adverse economic displacement due to the loss of a financial asset (e.g., land as an investment or rental property).
- Temporary disruption of income during the land acquisition process, such as during negotiations or legal processes.
- Vulnerable groups within this category, such as elderly landowners or female-headed households, may experience higher challenges in reinvesting compensation or accessing alternative income opportunities.

For landowners whose lands are partially acquired, and who are dependent on land-based livelihoods, the potential and/or existing impacts include:

- Economic displacement due to the partial loss of land and reduced productivity or fragmentation of remaining plots.
- Difficulty in maintaining the same level of agricultural or livestock productivity on fragmented or reduced landholdings.
- Vulnerable groups (e.g., elderly farmers or female-headed households) may face greater challenges in optimising the use of reduced land parcels or transitioning to alternative livelihoods.

For landowners whose lands are partially acquired, and who are not dependent on land-based livelihoods, the potential and/or existing impacts include:

- Limited adverse economic displacement due to loss of partial land income.
- Possible reduction in income from leased land or rental value if the partial acquisition reduces land utility.
- Minimal disruption to livelihoods or living conditions as primary income streams are independent of land

7.6.2.2 EMBEDDED CONTROLS

The Project’s primary embedded controls in relation to land procurement includes

- Optimisation of alignment to avoid and/or minimise social impacts: The current Project alignment was selected out of five (5) different options with the considerations of avoiding and minimising disturbances to local settlements and communities.

- The compensation to landowners in relation to the Project's land procurement is in line with Kazakhstan's national legislation on land expropriation for state-needs and has been assessed through state-licensed valuators engaged by District Akimats that considered the following:
    - Standardised base rates defined by Kazakhstan's cadastre system, considering official criteria such as land use, soil characteristics, geographic region, and infrastructure development.
    - Valuation of fixed assets on the required land.
    - Adjustment coefficients as determined by the valuator's professional judgment, taking into consideration characteristics of the land plot such as physical condition, location and market demand.

Semi-structured interviews revealed mixed data on the adequacy of the compensation for their lands. While most respondents were able to purchase alternate land plots, a few suggested that their land was undervalued or inadequate for a replacement plot in the same district.

7.6.2.3 ASSESSMENT OF IMPACT SIGNIFICANCE

Impact Magnitude: Medium

- Extent of Acquisition:

  A substantial portion of the land acquired for the Project is taken from private landowners primarily used for agricultural activities. Most landowners face partial acquisition of their properties, leading to direct economic displacement.
- Local Impact:

  The disruption remains localised to the areas where the project's footprint is established, limiting the geographical spread of significant adverse effects.
- Compensation and Alternative Lands:

  Although the economic displacement is considerable, the availability of other lands in the region and the project's commitment to fair compensation as per national land acquisition guidelines help mitigate the intensity of the impact. The project's alignment was optimised to reduce the amount of land acquired, further minimising the scope of displacement.
- Embedded Controls:

  The Project's approach includes detailed compensation mechanisms designed to align with Kazakhstan's national legislation on land expropriation, which helps to somewhat lessen the potential for severe economic distress among the affected landowners. While 64 out of 167 (38.32%) privately-owned land plots have been acquired and compensated, consultations indicate mixed success. Some landowners were able to purchase alternative land, while others faced financial struggles with debt and household needs, pointing to varying levels of adequacy in compensation enabling similar economic activities elsewhere.

Receptor Sensitivity: Medium

- The majority of affected landowners rely significantly on their land for their primary source of income and households reliant on land for subsistence or income are less adaptable to alternative livelihoods.

- Vulnerable groups (e.g., female-headed households, elderly landowners) make up an estimated 10%[305] of this category and have limited adaptive capacity due to reduced mobility or access to resources. Interview data from the SSIs conducted suggest the presence of economically vulnerable groups, even if their household income is above the subsistence income defined nationally in Kazakhstan. For instance, the compensation for the land plots is not received by some individuals as they are automatically channelled towards debt repayment. Rather than new land plots, some of the respondents indicated that the compensation received was used for fulfilling immediate household needs rather than the purchase of an alternative land plot.
- Due to the mixed profiles of affected landowners as suggested in the SSIs, the receptor sensitivity remains to be medium.

The impact significance is assessed as Moderate due to the combination of medium impact magnitude and medium receptor sensitivity.

- This assessment reflects the significant economic displacement faced by land-dependent households, especially as the private land acquisition of approximately 734.63 hectares across 167 land plots is permanent and irreversible.

7.6.2.4 MITIGATION MEASURES

- The affected landowners whose lands have not yet been acquired should be provided with either alternate land parcels with similar levels of productivity and characteristics which are well-suited to their livelihood means, along with financial assistance to prepare the land for crop cultivation or livestock rearing. However, if this is not feasible then adequate compensation at full replacement cost, as detailed in the Livelihood Restoration Plan should be provided. Livelihood restoration support may be additionally required for some affected households (vulnerable). This may be extended to those who have been compensated (land acquisition is complete) but have been found to be in the vulnerable category and may not have been able to restore their livelihoods to pre-Project levels, based on the compensation received.
- Those who have been/or will be rendered landless or with sub-optimal land holdings after the Project’s procurement of their private lands should be eligible for livelihood restoration support that may include relevant trainings towards the operations phase of the Project where possible or offered other forms of transitional support as detailed in the Livelihood Restoration Plan. This assistance should be for a period of time assessed to be adequate to help sustainably restore their incomes and livelihoods to pre-project levels.
- Additional support should be provided to vulnerable groups such as women-headed households who have been affected by the Project’s land procurement, through programs such as skills training and entrepreneurship support where possible, as detailed in the Livelihood Restoration Plan.
- A functional Grievance Redressal Mechanism to address concerns related to compensation, land acquisition processes, or other associated impacts should be operational for the duration of the planning phase and also cover (as relevant) the later Project phases.

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[305] Estimated from secondary data and sampled SSIs; to be further confirmed by consultation with a larger, representative sample of affected households and/or consultations with key informants such as District Akimats.

7.6.2.5 SUMMARY

The mitigation measures proposed will lower the residual impact significance to **Minor** by lowering the receptor sensitivity to low.

TABLE 7-38: IMPACT SIGNIFICANCE ON ECONOMIC DISPLACEMENT OF LANDOWNERS

Impact Significance on Economic Displacement on Landowners					
Potential Impact	Economic displacement from loss of land and impacts to land-based livelihoods, leading to income loss.				
Project Phase	**Pre-construction**	Construction	Operation		
Impact Nature	**Negative**	Positive	Neutral		
Impact Type	**Direct**	Indirect	Induced		
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
Impact Extent	**Local**	Regional	International		
Impact Scale	The impact is limited to the households with land-based livelihoods and who own land within the Project footprint, estimated at about 120 to 140 households.				
Frequency	The impact will only occur once: permanent acquisition of the land for the purposes of the Project will only occur once for the area required.				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Receptor Sensitivity	Low	**Medium**	High		
Impact Significance	Negligible	Minor	**Moderate**	Major	
Residual Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Residual Receptor Sensitivity	**Low**	Medium	High		
Residual Impact Significance	Positive	Negligible	**Minor**	Moderate	Major

7.6.3 ECONOMIC DISPLACEMENT OF LAND USERS

As outlined in **Section 7.3.5**, leased land plots constitute a significant portion of the Project-affected land, with leased farming being the predominant use. In total, 40 leased plots are partially acquired, while 10 are entirely acquired for Project-related activities. These leased lands serve a variety of purposes, including subsistence farming, small-scale livestock rearing, and large-scale commercial agricultural operations.

Economic displacement is anticipated for both leaseholders and land users who rely on these leased lands for their livelihoods. The severity of impacts is influenced by the extent of acquisition (entire or partial) and the nature of land-based activities being undertaken.

- Leaseholders engaged in peasant farming (including livelihood activities such as livestock grazing and subsistence crop farming) are expected to face significant impacts, particularly where entire plots are acquired, leading to a complete loss of access to land and disruption of agricultural or livestock-based livelihoods.

- In cases of partial acquisition, leaseholders may experience fragmentation of land, which could reduce productivity or render portions of the land unviable. This is particularly challenging for subsistence farmers and graziers, who may lack resources to adapt to reduced land access.

This analysis assesses impacts on leased land stakeholders, considering their dependence on land-based livelihoods and the extent of land acquisition (entire or partial) as summarised in **Table 7-39.**

TABLE 7-39: LAND USER CATEGORIES

Category		Proportion of land impacted (%)											Total
		0-10%	>10-20%	>20-30%	>30-40%	>40-50%	>50-60%	>60-70%	>70-80%	>80-90%	>90-100%	Data Gap	
Dependent on land-based livelihoods	No. of plots	13	5	3	2	1	1	1	1	2	4	NA	33
	Proportion of total (%)	39%	15%	9%	6%	3%	3%	3%	3%	6%	12%	NA	100%
Not dependent on land-based livelihoods	No. of plots	2	1	0	1	0	0	1	0	0	2	2	9
	Proportion of total (%)	22%	11%	0%	11%	0%	0%	11%	0%	0%	22%	22%	100%

Note: this analysis is based on the assumption that land use for leased farming indicates a dependency on land-based livelihoods while landowners indicating use for other purposes are not dependent on land-based livelihoods.

7.6.3.1 POTENTIAL AND/OR EXISTING IMPACTS

For land users impacted by complete loss of access to leased lands, and who are dependent on land-based livelihoods, the potential and/or existing impacts include:

- Economic displacement due to the complete loss of land-based livelihoods, directly affecting income and household security.
- Limited ability to transition to alternative livelihood sources, especially for small-scale or subsistence farmers (including livestock graziers).
- Compounded impacts faced by vulnerable groups such as elderly lease holders or low-income tenant farmers due to limited resources and/or inability to access alternative land suited to their livelihood purposes.
- Disruption of associated economic activities, such as seasonal farming, animal grazing, and access to agricultural markets.

For land users impacted by complete loss of access to leased lands, and who are not dependent on land-based livelihoods, the potential and/or existing impacts include:

- Partial economic displacement arising from the loss of access to non-primary or supplemental land use.
- Minimal disruption to livelihoods as income is derived primarily from non-land-based sources.
- Short-term inconvenience, such as relocation of informal activities, increased commuting distances, or adjustments to alternative locations.

For land users impacted by partial loss of access to the leased lands, and who are dependent on land-based livelihoods, the potential and/or existing impacts include:

- Reduced productivity and economic viability due to fragmentation or loss of portions of land, particularly where the remaining land is rendered less usable for farming or grazing.
- Increased costs of operations, as land users may need to modify farming or grazing practices (e.g., intensifying use of smaller parcels, accessing alternative grazing areas, or relocating irrigation facilities).
- Vulnerable land users, such as women-headed households and elderly farmers, may face challenges in adapting to the reduced access, as they typically have fewer financial or technical resources.

For land users impacted by partial loss of access to the leased lands, and who are not dependent on land-based livelihoods, the potential and/or existing impacts include:

- Minor disruptions to existing activities on the land due to partial inaccessibility, but these disruptions do not significantly impact overall livelihoods or income streams.
- Limited operational adjustments may be required for activities like temporary storage, informal trade, or recreational use.
- Minimal risk to vulnerable groups, as this category typically consists of individuals or entities with alternative income sources and higher adaptive capacity.

7.6.3.2 EMBEDDED CONTROLS

The Project's embedded controls related to leased land acquisition include:

- Alignment Optimisation: The Project alignment has been optimised to minimise disturbances to agricultural and leased land users while maintaining technical feasibility, as detailed in **Section 2** above**.**
- Notably, lease holders are not entitled to compensation under Kazakhstan's national legislation and regulations on land expropriation. While some leaseholders were able to obtain assistance from District Akimats in finding alternative plots of land to lease, or had their contracts adjusted to reflect the changes in leased land holdings, these were at the discretion of the district's land acquisition department.

7.6.3.3 ASSESSMENT OF IMPACT SIGNIFICANCE

Impact Magnitude: Medium

- Extent of Acquisition:

  Both complete and partial loss of access to land significantly affects land users who depend on these areas for agricultural activities and other land-based livelihoods. The impact is directly correlated with their primary income sources being disrupted or entirely lost.
- Local Impact:

  Impacts are localised primarily to the Project footprint, directly affecting 33 to 65 households engaged in land-based activities and an additional 7 to 15 households involved in non-land-based activities.

  The number of households affected (30 to 50 for partial loss and 6 to 10 for complete loss in land-based livelihoods) indicates a medium-level magnitude when compared to the Project's scope and the total population in the Project area.
- Economic Displacement:

  For those dependent on the land, the economic displacement is significant, ranging from complete to partial disruption of livelihoods. Those not dependent on the land for primary livelihoods experience limited economic displacement.
- Compensation and Alternative Access:

  Land users are not entitled to any compensation under the national legislation; obtaining assistance from District Akimats can be a complex process and may not fully address the loss of productive land. Interview data from stakeholder consultations indicated that all land users did not receive any financial compensation, and only some were offered assistance in procuring an alternative piece of land for their needs.
- Availability of Leased Lands:

  Stakeholder consultations and site observations indicated a general availability of land resources in the region. Additional interviews with persons impacted by land acquisition indicated that lands were generally available, and leaseholders or tenants were usually able to harvest their crops (if any) prior to the ownership transfer. The challenge was finding a suitable plot of land suited to their livelihood needs (for e.g. the availability of a free or affordable water source for irrigation purposes or for livestock rearing).

Receptor Sensitivity: Medium

- Land Dependency:
  Many affected land users, especially the 30 to 50 households experiencing partial loss of access, rely on the land for income and sustenance, though alternative employment or livelihood options are available in the region, somewhat mitigating their vulnerability. For instance, locals consulted shared that jobs in the construction sector and as shepherds are readily available in the area.
- Varying Levels of Vulnerability:
  The groups experiencing complete or substantial loss of access are more vulnerable due to their direct reliance on the land. However, those affected by partial loss and not dependent on land-based livelihoods display greater adaptability, reducing the overall sensitivity across the board.

The impact significance is assessed to be Moderate given the combination of medium impact magnitude and medium receptor sensitivity. The complete loss of access to land has severe consequences for the livelihoods of affected users, particularly those engaged in subsistence farming or livestock grazing, though it is abated by the availability of alternative jobs and lands available for agricultural lease in the region

7.6.3.4 MITIGATION MEASURES

- Where feasible, affected land users should be provided with alternative leased or tenant land of comparable size and productivity to restore their livelihoods.
- Develop targeted support programs as outlined in the Livelihood Restoration Plan (LRP), such as financial compensation, transitional allowances for vulnerable groups and support for livestock rearing to mitigate income loss.
- Additional support should be provided to vulnerable groups such as women-headed households who have been affected by the Project's land procurement, through programs such as skills training and entrepreneurship support where possible, as detailed in the Livelihood Restoration Plan.
- A functional Grievance Redressal Mechanism (GRM) to address concerns related to compensation, land acquisition processes, or other associated impacts, should be operational for the duration of the planning phase and also cover (as relevant) the later Project phases.

7.6.3.5 SUMMARY

The receptor sensitivity is lowered to medium due to increased adaptability facilitated by targeted mitigation measures. The residual impact significance is lowered to **minor.**

TABLE 7-40: IMPACT SIGNIFICANCE ON ECONOMIC DISPLACEMENT OF LAND USERS

Impact Significance on Economic Displacement on Land Users			
Potential Impact	Complete loss of access to land, disrupting land-based livelihoods.		
Project Phase	**Pre-construction**	Construction	Operation
Impact Nature	**Negative**	Positive	Neutral

Impact Significance on Economic Displacement on Land Users					
Impact Type	**Direct**	Indirect	Induced		
Impact Duration	Temporary	Short-term	**Long-term**	Permanent	
Impact Extent	**Local**	Regional	International		
Impact Scale	The impact is limited to the households using land where the Project footprint is located, especially the estimated 33 households leasing land for farming and livestock rearing.				
Frequency	The impact will only occur once: permanent acquisition of the land for the purposes of the Project will only occur once for the area required.				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Receptor Sensitivity	Low	**Medium**	High		
Impact Significance	Negligible	Minor	**Moderate**	Major	
Residual Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
Residual Receptor Sensitivity	Low	**Medium**	High		
Residual Impact Significance	Positive	Negligible	**Minor**	Moderate	Major

7.6.4 ECONOMIC DISPLACEMENT IMPACTS ON COMMERCIAL ENTITIES

Commercial entities whose lands are impacted by the Project, involve those engaged in various commercial activities such as agriculture, industrial operations, or other land-based businesses. These entities face economic displacement due to either complete or partial acquisition of their lands. **Table 7-41** provides an overview of the impacted commercial entities.

- Entire Acquisition: Affects entities whose entire landholdings are acquired. This leads to significant disruptions in their operations and potential loss of business.
- Partial Acquisition: Affects entities with only a portion of their land acquired. While this allows for some continuity of operations, it may lead to operational inefficiencies and increased costs

TABLE 7-41: OVERVIEW OF IMPACTED COMMERCIAL ENTITIES

Impacted plots	Proportion of land impacted (%)											Total
	0-10%	>10-20%	>20-30%	>30-40%	>40-50%	>50-60%	>60-70%	>70-80%	>80-90%	>90-100%	Data Gap	
No. of plots	13	5	3	2	1	1	1	1	2	4	NA	33
Proportion of total (%)	39%	15%	9%	6%	3%	3%	3%	3%	6%	12%	NA	100%

7.6.4.1 POTENTIAL AND/OR EXISTING IMPACTS

For commercial entities impacted by complete loss of access to their productive lands, the potential and/or ongoing impacts include:

- Economic displacement due to the loss of productive land and associated revenue streams.
- Disruption to supply chains and business operations, particularly for entities reliant on the acquired land for agricultural outputs or as part of a vertically integrated business model.
- Increased costs related to relocating operations, securing alternative land, and re-establishing commercial activities.
- Reputational impacts or loss of customer bases for entities unable to maintain continuity of supply or services.

For commercial entities impacted by a partial loss of access to their productive lands, the potential and/or ongoing impacts include:

- Reduced operational efficiency due to fragmentation of land, which may result in higher operational costs and reduced productivity.
- Adjustment costs, including reconfiguring existing operations, infrastructure, and supply chains to adapt to reduced land availability.
- Diminished economic viability, particularly for smaller commercial entities or those reliant on economies of scale.
- Potential reduction in land suitability for its original purpose, such as industrial-scale operations or intensive agriculture.

7.6.4.2 EMBEDDED CONTROLS

- Alignment Optimisation: The Project alignment has been optimised to minimise disturbances to commercial and industrial operations while maintaining technical feasibility, as detailed in **Section 2.2.**
- Compensation: Compensation for procured land is aligned with Kazakhstan's national legislation. For commercial entities leasing land, the compensation is determined based on the value of their leasehold rights and any investments made in the land, including commercial assets. Respondents surveyed by ERM shared that they were able to resolve challenges faced during the land acquisition process through negotiation with the District Akimat.

7.6.4.3 ASSESSMENT OF IMPACT SIGNIFICANCE

Impact Magnitude: Medium

- Extent of Acquisition:
  Entire acquisition of lands which commercial entities operate on can critically affect business continuity and revenue streams. Partial acquisition may impact commercial entities to a lesser extent, but is dependent on the assets or operations affected, and how crucial they are to the commercial entity. Most of the commercial entities impacted faced entire acquisition of their lands.
- Economic Impact:

  Significant for those completely acquired; moderate for partial acquisitions due to retained but reduced operational capacity.

- Local Impact:

  Although impacts are localised to the project area, they may affect critical aspects of the commercial operations within that footprint. However, the impacts remain limited due to the relatively small number of commercial entities impacted in relation to the population within the Project area (18 to 27commercial entities across both complete and partial acquisition categories).

Receptor Sensitivity: Medium

- Adaptive Capacity:
  Commercial entities often have higher adaptive capacity, including financial resources, organisational support, and access to markets, which mitigate their sensitivity. They may also be able to better access existing re-evaluation mechanisms through the court due to access to financial resources.
- Vulnerability:
  However, smaller or locally operated commercial farms may face greater challenges due to limited relocation options or higher dependency on local resources and infrastructure.

The impact significance is assessed to be Moderate due to the direct impact on the operations of commercial entities and the potential for significant economic displacement.

7.6.4.4 MITIGATION MEASURES

- Ensure that compensation for acquired plots is in line with the Livelihood Restoration Plan, reflecting the replacement cost including the value of lost revenue, operational costs, assets and investments.
- Facilitate access to alternative plots that match the productivity and strategic needs of the entities, close to existing supply chains where possible, for entities yet to be relocated. Facilitate access to additional leased plots where feasible to offset productivity losses to land plots which will be partially acquired.
- Provide financial compensation and transitional support to cover the costs associated with relocation and operational reestablishment for entities yet to be relocated, where possible.
- Provide targeted financial assistance and capacity-building programs to reduce the vulnerability of small-scale commercial leaseholders.
- A functional Grievance Redressal Mechanism to address concerns related to compensation, land acquisition processes, or other associated impacts, should be operational for the duration of the planning phase and also cover (as relevant) the later Project phases.

7.6.4.5 SUMMARY

With the effective implementation of the mitigation measures, **the residual impact significance will be lowered to Minor**, as commercial entities are better able to find alternatives, increasing their adaptability and lowering the receptor sensitivity to low.

TABLE 7-42: IMPACT SIGNIFICANCE ON ECONOMIC DISPLACEMENT IMPACTS ON COMMERCIAL ENTITIES

Impact Significance on Economic Displacement on Commercial Entities	
Potential Impact	Loss of access to land, disrupting commercial operations (entire or partial)

Impact Significance on Economic Displacement on Commercial Entities					
Project Phase	**Pre-construction**	Construction	Operation		
Impact Nature	**Negative**	Positive	Neutral		
Impact Type	**Direct**	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	**Permanent**	
Impact Extent	**Local**	Regional	International		
Impact Scale	The impact is limited to the commercial entities operating on the land where the Project footprint is located, estimated at 18 to 27 commercial entities				
Frequency	The impact will only occur once: permanent acquisition of the land for the purposes of the Project will only occur once for the area required.				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Receptor Sensitivity	Low	**Medium**	High		
Impact Significance	Negligible	Minor	**Moderate**	Major	
Residual Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
Residual Receptor Sensitivity	Low	**Medium**	High		
Residual Impact Significance	Positive	Negligible	**Minor**	Moderate	Major

7.6.5 IMPACTS ON WORKERS: LOSS OF EMPLOYMENT DUE TO LAND ACQUISITION

For workers employed by commercial entities affected by the Project, the acquisition of land (both privately owned and leased, complete or partial) has the potential to cause employment loss and related economic disruptions.

7.6.5.1 POTENTIAL AND/OR EXISTING IMPACTS

- Loss of employment and income for workers directly dependent on the affected commercial entities, particularly those operating in agriculture or industrial sectors.
- Reduced economic activity in local communities as employment opportunities diminish, potentially affecting local supply chains and secondary livelihoods, though this is likely to be of a small magnitude due to the Project's linear alignment and land take comprising of a relatively narrow corridor.
- Difficulty finding alternative employment for affected workers, particularly those with limited skills or specialised roles tied to specific industries (e.g., poultry farms or large-scale agricultural operations). Employment losses are likely to be temporary, as consultations indicated that alternative employment is generally available in the region, in the agriculture and in other sectors such as construction.

7.6.5.2 EMBEDDED CONTROLS

- There are no Project-specific embedded controls for workers facing a loss of employment due to the Project's land procurement.
- However, the Project's procurement policy, as aligned with Kazakhstan's national laws, obligates it to procure and employ locally where possible.

7.6.5.3 ASSESSMENT OF IMPACT SIGNIFICANCE

The impact magnitude is assessed to be medium:

- The loss of employment impacts workers directly dependent on commercial entities, estimated at 20 to 100 workers.
- The magnitude varies based on the type of acquisition:
  - Complete acquisitions result in total loss of employment opportunities.
- Partial acquisitions may lead to reduced operations, affecting a portion of the workforce.
- Impacts are localized but significant for affected workers, with ripple effects on local communities.
- Due to general work availability in the region, the impacts on employment loss are expected to be temporary for most workers.

The receptor sensitivity is assessed to be medium:

- Workers reliant on single employers or specialised roles have limited adaptability to sudden job loss.
- Households dependent on the affected workers for income may experience compounded economic stress.
- However, this is abated by the availability of jobs in the region, though there may be associated costs in relation to transport or commutes if workers must travel further. Locals and impacted stakeholders interviewed by ERM shared that work in the agricultural sector in the area is generally available, though people may have to travel further. Those that live close to Almaty city may also search for alternative jobs in the city, as is preferred by the younger generation. Additionally, there are also alternative jobs such as in the construction sector, which has seen increased demand in recent years due to the increased demand in infrastructural projects in the region.

The impact significance is assessed as Moderate.

7.6.5.4 MITIGATION MEASURES

- Provide a six-month transition allowance aligned with the national minimum wage to skilled workers employed by impacted commercial entities.
- Offer targeted support to vulnerable workers (e.g., women, elderly employees) to address unique challenges in finding alternative employment as outlined in the Livelihood Restoration Plan.
- A functional Grievance Redressal Mechanism to address concerns related to compensation, land acquisition processes, or other associated impacts, should be operational for the duration of the planning phase and also cover (as relevant) the later Project phases.

7.6.5.5 SUMMARY

The impact magnitude is reduced to medium and the receptor sensitivity is lowered to low with the implementation of the mitigation measures. **The residual impact significance is assessed to be Minor.**

TABLE 7-43: IMPACT SIGNIFICANCE ON ECONOMIC DISPLACEMENT IMPACTS ON WORKERS FACING LOSS OF EMPLOYMENT

Impact Significance on Economic Displacement of Workers Facing Loss of Employment					
Potential Impact	Temporary loss of income and/or livelihood, until alternative employment is found.				
Project Phase	**Pre-construction**	Construction	Operation		
Impact Nature	**Negative**	Positive	Neutral		
Impact Type	**Direct**	Indirect	Induced		
Impact Duration	**Temporary**	Short-term	Long-term	Permanent	
Impact Extent	**Local**	Regional	International		
Impact Scale	Impacts directly affect an estimated 20 to 100 workers, with severity varying based on type and extent of land acquisition.				
Frequency	The impact will only occur once when the land is acquired for the Project.				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Receptor Sensitivity	Low	**Medium**	High		
Impact Significance	Negligible	Minor	**Moderate**	Major	
Residual Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Residual Receptor Sensitivity	**Low**	Medium	High		
Residual Impact Significance	Positive	Negligible	**Minor**	Moderate	Major

7.6.6 IMPACTS ON LOCAL SETTLEMENTS ALONG THE ALIGNMENT

7.6.6.1 POTENTIAL AND/OR EXISTING IMPACTS

Loss of Communal Grazing Lands:

Communal grazing lands provide critical resources for livestock-reliant communities along the alignment, supporting both subsistence and small-scale commercial livelihoods. These lands are typically located on state-owned land but may also include informal arrangements with private landowners.

While none of the affected respondents and key informants interviewed identified direct impacts on communal grazing land due to the Project's land procurement, the acquisition of state lands reduces the amount of land available which can be designated as communal grazing lands. Akimats interviewed by ERM shared that each district has designated communal grazing lands and routes which are seasonal in nature, though it is unclear if the Project's land requirements impact designated communal grazing areas directly, or if alternative arrangements have already been made by the Akimats. The acquisition of state land for the Project, however, impacts the amount of land available for rotation and seasonal, communal grazing for the villagers living along the alignment.

The Project's acquisition of such lands could lead to reduced access for local communities, potentially disrupting traditional livestock grazing patterns and economic activities. Communal grazing lands serve as shared resources, particularly for vulnerable groups such as lower-income households who may rely heavily on these areas for their livelihoods. Communities along the alignment rely on these lands for the grazing of sheep, cattle, and other livestock, which constitute essential components of household income and subsistence.

Disruption of Household and Community Activities:

- The Project's land procurement can make it more challenging for residents to access communal areas, markets, schools, or healthcare services. This bifurcation can necessitate longer routes to these essential services, impacting daily routines and increasing travel costs.
- The disruption may also affect local economic activities, especially for those reliant on the transport of goods across what will now be a divided landscape. For instance, small-scale agricultural producers might find it harder to access local markets or receive supplies

7.6.6.2 EMBEDDED CONTROLS

- Construction of cattle underpasses: six (6) concrete bridges were planned to be constructed as part of the Project design, serving as cattle overpasses to minimise impacts of land fragmentation on grazing due to the Project.
- One (1) railway overpass was also designed to provide passage for agricultural machinery along the alignment.
- The Project design also provided four (4) railway overpasses to bridge existing roads affected by the alignment construction which were designed for vehicular traffic.

7.6.6.3 ASSESSMENT OF IMPACT SIGNIFICANCE

Impact Magnitude: Small

- There is widespread reliance on communal grazing lands in settlements along the alignment.
- Household and community activities are affected by the bifurcation of the land areas on either side of the Project alignment due to the nature of the long, narrow corridor of the Project alignment.
- While there are cattle underpasses and railway overpasses embedded in the Project design to mitigate the impacts of land fragmentation on communal grazing activities and general accessibility, some of the impacted landowners and land users engaged were unaware of the presence of cattle underpasses and road overpasses as part of the Project design. This indicates a need for better communication and information dissemination to affected parties.
- There are localised effects on community livelihoods and livestock productivity.

Receptor Sensitivity: Medium

- Smallholder farmers and livestock-reliant households are likely to be dependent on communal grazing resources.
- Vulnerable groups such as women-headed and lower-income households may be more reliant on communal resources due to their limited financial resources and adaptive capacity.
- However, the sensitivity is assessed as medium, due to the general availability of grazing resources on either side of the alignment. The grazing areas are also seasonal, and subject to change depending on the land conditions. The impacts due to the loss of access to communal grazing lands, if any, are expected to be temporary.

The impact significance is assessed to be Minor.

7.6.6.4 MITIGATION MEASURES

- Conduct community meetings to inform affected stakeholders about the locations, design, and utility of cattle underpasses and rail overpasses.
- Work with Akimats to identify and allocate alternative grazing areas near the affected communities. Facilitate community-based grazing initiatives as outlined in the Livelihood Restoration Plan.
- For vulnerable groups such as lower-income households impacted by the loss of access to communal grazing lands, offer support for feed or supplementary grazing resources during the transition.
- Seasonal or six monthly-monitoring of the adequacy of cattle passes provided by the Project in the construction and operational phase.
- A functional Grievance Redressal Mechanism, disclosed to all affected settlements, to address concerns related to compensation, land acquisition processes, or other associated impacts, should be operational for the duration of the planning phase and also cover (as relevant) the later Project phases.

7.6.6.5 SUMMARY

The implementation of the mitigation measures will lower the residual receptor sensitivity to low. **The residual impact significance is assessed to be Negligible.**

TABLE 7-44: IMPACT SIGNIFICANCE ON ECONOMIC DISPLACEMENT OF COMMUNAL LAND USERS DUE TO LOSS OF COMMUNAL GRAZING LANDS

Impacts on Local Communities in Settlements Along the Alignment				
Potential Impact	Loss of communal grazing lands impacts local communities' access to resources for livestock.			
Project Phase	**Pre-construction**	Construction	Operation	
Impact Nature	**Negative**	Positive	Neutral	
Impact Type	**Direct**	Indirect	Induced	
Impact Duration	**Temporary**	Short-term	Long-term	Permanent
Impact Extent	**Local**	Regional	International	

Impacts on Local Communities in Settlements Along the Alignment					
Impact Scale	Directly impacts an estimated 15 to 30 settlements.				
Frequency	Ongoing or continuous, unless alternative communal grazing lands are made available.				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
Receptor Sensitivity	Low	**Medium**	High		
Impact Significance	Negligible	**Minor**	Moderate	Major	
Residual Impact Magnitude	Positive	**Negligible**	Small	Medium	Large
Residual Receptor Sensitivity	**Low**	Medium	High		
Residual Impact Significance	Positive	**Negligible**	Minor	Moderate	Major

7.7 ASSESSMENT OF IMPACTS DURING CONSTRUCTION

The potentially impacted receptors assessed in this section are primarily the labour force and businesses operating in the region of Almaty and the surrounding regions within Kazakhstan, as well as the regional and national government of Kazakhstan.

The key activities with potential impacts on employment and the economy at a local, regional and national level during the construction phase of the Project include:

- Direct employment in construction.
- Economic opportunities created through local procurement.
- Capacity building for local construction workers, subcontractors and suppliers.
- Indirect employment and economic opportunities created through presence of workers.

7.7.1 ECONOMIC AND EMPLOYMENT OPPORTUNITIES

7.7.1.1 POTENTIAL AND/OR EXISTING IMPACTS

Direct Employment Opportunities

According to KTZ, approximately 1,400 workers are required during the construction phase. Poligram the appointed Project Engineer of the Project noted that local labour can potentially be involved as auxiliary workers and qualified specialists in the production of construction and installation works, though "the main workforce is provided by a subcontractor selected as a result of a tender" [306]. While ERM was not provided with data on the skill level required for the different types of workers hired, an indicative list was provided in relation to the subcontracting organisations, construction equipment and personnel required for the Project's earthworks and linear structure construction. For earthworks alone, 544 workers subcontracted from nine (9) companies will be involved while for linear structures, 531 workers will be

[306] Poligram (2022) Construction Management Plan

subcontracted from the same number of companies. During a consultation with the head of the subcontractor "Standard-1" in the Reconnaissance Visit, it was highlighted that all subcontracted workers from "Standard-1" will be from Kazakhstan, though they may come from different regions. Furthermore, during the social site visit in October 2024, ERM verified though an interview with another subcontractor, the head of construction from KCT, that all their 70 workers from KCT are from Kazakhstan.

8.45% of the employed population in the Almaty region are qualified workers working in the industry construction, transport and other related occupations. Additionally, 23.5% of the unemployed population in Almaty remain unemployed despite having relatively high education levels of secondary general education and above. These two (2) groups can likely be employed in skilled or semi-skilled work through the Project construction and its associated activities.

24.69% of the active labour population in the Almaty region are considered unqualified workers, working as cleaners, as workers in agriculture, construction, manufacturing and as street vendors among others. This group of workers can potentially be employed in semi-skilled and less skilled jobs in the Project construction, though the extent to which they can benefit is unclear as it would likely depend on the skill-level of available positions to be filled, and the hiring process of contractors and subcontractors for said jobs.

The presence of an active labour force and potential livelihood opportunities created by the Project is echoed by ERM's site findings. One of the residents from Kosozen village in Iliy District shared that 90% of the children in the villages in the SAoI attain high school or college level qualifications, and some obtain university degrees. In another focus group discussion conducted in Kazybek Bek, one woman highlighted her opinion that a benefit of the project would be potential employment opportunities for her son who had just graduated from college.

Local Employment and Procurement

The Project's procurement process is regulated by the Procurement Procedure of the National Welfare Fund, a joint-company comprising of "Samruk-Kazyna" and legal entities, fifty or more percent of the voting shares (participation shares) of which directly or indirectly belong to JSC "Samruk-Kazyna". This Procurement Procedure has been developed in accordance with the Law of the Republic of Kazakhstan dated 8 June 2021 No. 47-VII ZRK "On Procurement of Certain Subjects of the Quasi-public Sector" and regulates the procurement process of Samruk-Kazyna JSC and the Fund's organisations. According to the Procurement Procedure made available to ERM, the Project is obligated to ensure that purchases of goods, works, services included in the procurement categories prioritise sourcing from local producers where possible.

Additionally, the Project is able to demand the following of its suppliers in the procurement process:

- Establish a counter obligation of a potential supplier to create new jobs in the city of Zhanaozen for citizens of the Republic of Kazakhstan registered at the place of residence in the city of Zhanaozen in the course of long-term purchases of goods over at least a 24-calendar month period;
- On the basis of the decision of the local executive body of the city of Zhanaozen provided for by this paragraph, the customer shall establish a counter obligation in accordance with paragraph 3 of the Regulations in coordination with the Procurement Fund Operator, the NCE and the local executive body of the city of Zhanaozen; and

- For the purposes of paragraph 3 of the Regulations, the local executive body of the city of Zhanaozen makes a decision on establishing the number of jobs to be created in the context of the required specialties (professions) in agreement with the National Chamber of Entrepreneurs of the Republic of Kazakhstan.

Capacity Building for Workforce

The Project will result in long-term capacity enhancement for the local workforce employed during the construction period. Specifically, this includes long-term benefits from on-the-job and formal training opportunities for individual workers and the possibility for capacity enhancements for companies who would have won tenders for work. Poligram highlighted that the project provides opportunities for training of workers in terms of skilling new workers, re-skilling workers, and providing advanced training for specialists[307]. Companies involved in procurement or as subcontractors can also reap reputational benefits from working on a major rail Project of national importance. The scale and importance of the Project for local and national firms involved was shared with ERM by an informant from Poligram: the company faced stiff competition from other firms in the tender process and KTZ is the company's largest and most important client.

Indirect Employment and Economic Opportunities

Other than direct employment in the activities required during the Project construction, employment opportunities created also include jobs such as those involved in the supply of goods and services required to support the Project's construction process, food and transportation services, and any other support services required for the labour accommodation. Additionally, given the physical presence of the labour workforce involved in the construction, there is likely to be temporary induced economic impacts of increased spending on goods and services on the local economy due to the construction workers present in the SAoI. Residents from Kazybek Bek highlighted that the Project has led to the creation of jobs and that small businesses have seen increased profits due to the activities surrounding the Project construction. They shared that small businesses selling spare parts have opened due to the increased economic activity in relation to the Project.

Additionally, at a regional and even national level, the Project's construction has spurred economic development. According to the Kazybek Bek Akim interviewed by ERM, the development of the Project has spurred the investments in the area, including the construction of a new industrial zone and a Special Economic Zone (SEZ). Reportedly, the Project passes through an industrial zone planned in the village and the Akim expects that by the end of the Project's construction phase, construction for the industrial zone will commence. The SEZ anticipates investors from Uzbekistan and China and is expected to house over 6,000 workers in its residential zone, provide jobs for locals and support competition within the domestic industry.

7.7.1.2 ASSESSMENT OF IMPACT SIGNIFICANCE

It is expected that the Project has a generally **positive impact** on employment and opportunities for residents within the SAoI and the broader national economy within Kazakhstan.

[307] Poligram (2023) Operational Design

7.7.1.3 SUMMARY

No impact significance is assigned. The assessment of positive social impacts on economic opportunities and employment is summarised below.

TABLE 7-45: IMPACT SIGNIFICANCE ON ECONOMIC IMPACTS DURING CONSTRUCTION

Impact Significance of Economic Impacts on Workers					
Potential Impact	• Direct employment in construction. • Economic opportunities created through local procurement. • Capacity building for local construction workers, subcontractors and suppliers. • Indirect employment and economic opportunities created through presence of workers.				
Project Phase	Pre-construction		**Construction**		Operation
Impact Nature	Negative		**Positive**		Neutral
Impact Type	**Direct**		**Indirect**		Induced
Impact Magnitude	**Positive**	Negligible	Small	Medium	Large

7.7.2 LABOUR AND WORKING CONDITIONS

7.7.2.1 POTENTIAL AND/OR EXISTING IMPACTS

The labour laws in Kazakhstan are governed by the Labour Code of the Republic of Kazakhstan. In comparison to the IFC Performance Standard 2 (PS2): Labour and Working Conditions, the gaps in Kazakhstan's national legislation include:

- **Discrimination in the Workplace**: While the Labour Code includes provisions for non-discrimination, implementation remains inconsistent. Effective mechanisms for enforcing protections against workplace discrimination based on gender, ethnicity, or socio-economic status are lacking, which falls short of the IFC standards advocating for fair treatment and equal opportunities for all workers.
- **Protections for Migrant Workers**: National legislation offers limited protections tailored to the unique vulnerabilities of migrant workers. In contrast with IFC’s Performance Standards, which emphasize the need for clear rights and support mechanisms for migrant workers, existing regulations do not sufficiently facilitate their integration or protect them from exploitation. Additionally, while rolling stock for the railway may be sourced domestically, the possibility of international suppliers bringing in migrant workers introduces further complexities. These could include challenges related to enforcement of labour protections and ensuring alignment with IFC standards for fair treatment and equal opportunities.
- **Prevention of Forced and Bonded Labour**: Although Kazakhstan's laws prohibit forced labour, the nuances of bonded labour and economic coercion are not adequately addressed. In contrast, IFC standards demand comprehensive measures to eliminate all forms of forced labour, ensuring that contracts are free from coercion and deception, which are not fully reflected in national legislation.
- **Child Labour Provisions**: National legislation on child labour lacks rigorous enforcement and comprehensive preventative measures. IFC standards explicitly call for the prohibition of child labour and implementing safeguards to prevent exploitation, which are not sufficiently addressed in Kazakhstan's current laws.

- **Occupational Health and Safety Regulations**: Although Kazakhstan has established health and safety regulations, compliance and enforcement can be inconsistent. The IFC standards require proactive health and safety management systems, reflecting ongoing engagement with workers in safety matters, which is still developing in national practices.
- **Worker Accommodation Standards**: Kazakhstan's regulations do not specify adequate living standards for worker accommodations, particularly regarding hygiene and safety. The IFC standards emphasize the importance of ensuring that all workers have access to adequate housing that meets basic health and safety criteria, which is not comprehensively mandated in Kazakhstan's legislation.

7.7.2.2 EMBEDDED CONTROLS

- The Project is obligated to procure locally where possible, so the risk of discrimination in the workplace is low due to the low numbers of migrant workers (if any) present in the workforce.
- The Project complies with the requirements of SN RK 1.03-05-2011 "Occupational Health and Safety in Construction." This includes the provision of personal protective equipment (PPE), measures for collective protection of workers, and adherence to safety regulations for work practices.
- Accommodation standards for workers include sanitary facilities and devices that will be provided before the start of construction and installation works at the facility.
- Prior to the commencement of construction, the customer and the general contractor, alongside subcontractors, are required to issue an admission certificate. This certificate specifies the safety measures that must be implemented and holds construction organisation heads responsible for these measures.
- Before starting work in conditions of industrial risk, the Project mandates the identification of areas that are hazardous for people, including locations near uninsulated current-carrying parts of electrical installations, unguarded height differences, and places where harmful production factors may exceed permissible levels.
- For areas with hazardous production factors, work permits must be issued for the execution of high-risk work, ensuring stringent safety measures are in place prior to commencing such activities.
- Heads of construction and installation organisations are required to organise labour safety training for workers before they are admitted to work, ensuring that all personnel are adequately informed of safety protocols and practices.
- The construction site will include clear signage for driveways and passages to promote safety, and danger zones will be fenced and marked with warning signs and inscriptions at all times.
- The Project will designate areas for first aid kits and emergency response equipment, ensuring that workers have access to necessary medical support.
- All workers on the site will be provided with drinking water that meets sanitary requirements, along with adequate sanitary facilities to ensure health and hygiene at the construction site.
- Adequate illumination will be provided for work sites, workplaces, and passages, in line with the "Instructions for the design of electric lighting of construction sites."

- An access control system (ACS) will be implemented to monitor the entry and exit of personnel, restricting access to unauthorized individuals and ensuring that only qualified personnel are present on site.

7.7.2.3 ASSESSMENT OF IMPACT SIGNIFICANCE

Impact Magnitude: Medium

- Inconsistent implementation of labour safety measures may lead to occasional risks, but they are not expected to result in significant accidents or injuries on site. Workers interviewed by ERM shared that no major injuries or fatal accidents have happened to their knowledge, indicating the effectiveness of embedded controls in ensuring workers' health and safety.
- Limited protections for migrant workers may pose some risks of exploitation; however, the overall number of migrant workers on the site is low, reducing the potential for widespread issues.
- Existing provisions aimed at preventing forced labour and child labour are in place, and while enforcement could be improved, the likelihood of major violations occurring is considered low.

Receptor Sensitivity: Low

- Respondents interviewed by ERM shared that it is relatively easy to find alternative employment in the construction sector.

Hence the impact significance is assessed to be Minor.

7.7.2.4 SUMMARY

Table 7-46 describes the assessment of impacts on labour and working conditions during the construction phase of the Project. No mitigation measures are proposed as the impact significance is assessed to be minor, and the duration of the impacts is expected to be short (only during construction).

TABLE 7-46: IMPACT SIGNIFICANCE ON LABOUR AND WORKING CONDITIONS DURING CONSTRUCTION

Assessment of Impacts on Labour and Working Conditions During Construction					
Potential Impact	• Occupational health and safety risks for workers. • Accommodation and living conditions on site.				
Project Phase	Pre-construction	**Construction**	Operation		
Impact Nature	**Negative**	Positive	Neutral		
Impact Type	**Direct**	Indirect	Induced		
Impact Duration	Temporary	**Short-term**	Long-term	Permanent	
Impact Extent	**Local**	Regional	International		
Impact Scale	Limited, as issues like safety risks and labour rights concerns are not pervasive and are effectively mitigated through embedded controls.				
Frequency	Occasional risks associated with inconsistent implementation of labour safety measures				
Impact Magnitude	Positive	Negligible	**Small**	Medium	Large

Assessment of Impacts on Labour and Working Conditions During Construction					
Receptor Sensitivity	**Low**	Medium	High		
Impact Significance	Negligible	**Minor**	Moderate	Major	
Residual Receptor Sensitivity	**Low**	Medium	High		
Residual Impact Significance	Positive	**Negligible**	Minor	Moderate	Major

7.7.3 COMMUNITY HEALTH AND SAFETY

7.7.3.1 POTENTIAL AND/OR EXISTING IMPACTS

The Project has the potential to cause various community health and safety issues.

Potential direct impacts associated with transport movements and general construction activities include:

- Increased traffic due to movement of construction vehicles and machinery causing injuries and/or loss of life
- Noise, vibration and dust resulting from general construction activities, which can cause disruptions in daily life and health impacts; exacerbation of respiratory diseases prevalent in the region (e.g. upper respiratory tract infections).

These impacts will be limited to the construction phase, given that there will not be deliveries of material during the operation phase. A limited operational workforce will need to commute to the site for maintenance or other activity.

Potential impacts associated with in-migration due to the Project's labour requirements include:

- *Presence of security personnel leading to risk of conflict*

  According to the head of KCT construction, one of KTZ's subcontractor, each subcontractor is required to make their own security arrangements. Generally, security teams are stationed only at labour camps, storage areas and vehicle parking areas. He estimated that there are about one to two security guards at each construction camp at night and that there is no security presence in the day. The security guards are not armed, and the other security measure used is the installation of surveillance cameras at the labour camps. The respondent shared his view that security teams are not needed on the Project construction site.

  While ERM did not find evidence of any known conflict involving the presence of security personnel, if conflict arises between the Project and villagers, there is a risk that security personnel, as has been seen in other large-scale developments, may use excessive force, which in turn can pose a risk of human rights impacts.

- *Change in community dynamics; potential increase of gender-based violence*

  The increased population due to the presence of a construction workforce, typically made up of males working away from home, may attract sex workers to the local area. Female villagers who are vulnerable may also seek to capitalise on the availability of disposable income of construction workers, and may seek out transactional sex. Notably, villagers did not raise the prevalence of sex workers as an existing issue within the villages in the AoI. It is noted that the majority of workers required during the construction phase will be locals, hence lowering the risk of human trafficking and transactional sex.

- *Spread in infectious diseases*

  The prevalent infectious diseases in the SAoI include acute upper respiratory infections, measles and tuberculosis. The increase in population density caused by the in-migration of workers may lead to the spread of infectious diseases, especially if the construction workers live in the same residential areas as the affected population.

  ERM noted that there are two labour camps constructed for workers' accommodation, thereby lowering the risk of the spread of infectious diseases if any. However, it is unclear as to how many of the workers are housed in dedicated workers' accommodation, as other respondents have shared with ERM that they do not live in workers' labour accommodation camps.

  Additionally, if there is an increase in transactional sex as mentioned in the earlier sub-section, there is a risk of the spread of sexually transmitted diseases such as HIV, syphilis and gonorrhoea. As identified in the baseline, syphilis is a leading infectious disease identified in both Kazakhstan and the Almaty region.

- *Public and social infrastructure strain*

  The in-migration of approximately 1,500 workers during the construction phase can increase the strain on public and social infrastructure, particularly on local health facilities. In comparison to the national average, the Almaty region has a smaller number of doctors, secondary medical personnel, hospitals and hospital beds per 10,000 persons. During a KII with the Iliy District Akimat, the representative mentioned that while there are public hospitals available, private hospitals and hospitals in Almaty City provide better care in comparison.

  Additionally, during the Project construction, two (2) sources of groundwater will be drawn from existing farmland. However, as the amount of groundwater anticipated to be used is small, and the remaining water needs are fulfilled through imported water, any impacts on water supply will be limited and temporary in scope.

Health and safety risks to settlements near construction sites and labour camps:

Settlements near construction sites and worker accommodations face increased exposure to health and safety risks during the construction phase due to large-scale infrastructure works, the presence of heavy machinery, and workforce in-migration. These risks include:

- **Accidental injuries from construction activities:** The presence of open excavation sites, heavy machinery, and construction materials poses a risk to local residents, especially children. Unauthorized entry into construction areas could lead to accidents. Preventive measures, such as fencing, warning signs, and public awareness campaigns, should be implemented.
- **Water and soil contamination:** Construction work, including improper disposal of hazardous materials and wastewater, could contaminate local water sources and agricultural land. This could pose risks to human health and livestock.
- **Emergency preparedness and fire risk:** During construction, fire risks may arise due to electrical faults, welding, and fuel storage in laydown area, labour camps that are either within or near settlements. Additionally, emergency situations, such as accidents, natural

disasters, or medical emergencies, could impact both workers and the surrounding community, unless precautions are used and/or these facilities are located at a safe distance from local settlements.

7.7.3.2 EMBEDDED CONTROLS

- ERM found on site that the responsibility for security rests with each subcontractor; and that the proponent of the Project, KTZ, has no oversight on the use or hiring of security guards. Information received from KTZ suggests no security agency is formally contracted and there are no armed security guards in the Project area.
- According to one of the subcontractors interviewed by ERM, there is no formal, written code of conduct for subcontractors. Rather, they are bound by an Admission Order signed between KTZ and the contractor. An Admission Order typically refers to an official document or directive that allows a subcontractor or their workers to access a construction site and commence their contracted duties. It is often part of the formalized procedures to ensure compliance with safety, regulatory, and contractual obligations on a construction project.
- The labour accommodation camp at Sorbulak is located 11km from the nearest settlement (Mezhdurechenskoye), and the camp at Zhana Arna is also likely far from communities, with the nearest settlement Zhanalyk being approximately 5km away. This distance helps mitigate risks related to worker-community interactions, including public health concerns and social tensions.
- Currently, fire detection systems are not installed along the railway corridor. Fire incidents rely on train drivers reporting to the nearest station master.
- The existing approach for wildfire risk management involves controlled burning of dry vegetation along railway tracks and deployment of fire trains.

7.7.3.3 ASSESSMENT OF IMPACT SIGNIFICANCE

The assessment of the significance of impacts associated with worker in-migration due to construction activities is based on the criteria set out in **Section 5.**

Impact Magnitude: Medium

- Increased traffic from construction vehicles may lead to localized disruptions and pose risks to residents, potentially resulting in injuries or loss of life.
- Noise, vibrations, and dust from construction activities can adversely affect health, particularly exacerbating respiratory conditions prevalent in the community.
- The presence of security personnel may increase tensions, though largely mitigated by their unarmed status and confined responsibilities.
- The in-migration of workers can alter community dynamics, heightening the risk of gender-based violence and the spread of infectious diseases, particularly sexually transmitted infections due to increased population density and possible transactional relationships.
- Health and safety risks to surrounding communities during the construction phase can cause injury and/or loss of life depending on the gravity of the scenario, though the construction sites are expected to be access controlled with adequate precautions for non-authorised people to be prevented from accessing these areas (see **Construction Environmental and Social Management System**).

- Lastly, the construction phase is likely to strain public and social infrastructure, including healthcare services given that these will have to cater to the construction workers. However, this is likely to be temporary, and only for the period of the construction.

Receptor Sensitivity: Medium

- Residents have a high dependence on land-based livelihoods, which can constrain their adaptability to the disruptions caused by increased construction activities, especially among marginalized groups.
- Vulnerable populations, particularly women and children, face greater risks related to gender-based violence and health issues arising from the increased mobility of workers and potential changes in local social dynamics.
- The existing health infrastructure is already under strain, making it difficult to absorb additional pressure from an influx of workers.

Hence the impact significance is assessed to be Moderate.

7.7.3.4 MITIGATION MEASURES

- The following provides a brief overview of suggested mitigation measures. Detailed mitigation measures are presented in Section 1 (ESMP).

Traffic Management Plans

- Implement strict traffic management strategies during the construction phase to minimise risks associated with increased vehicle movement. This may include designated routes for construction vehicles, traffic control personnel, and scheduling deliveries to avoid peak hours.
- Install signage and barriers around construction sites to enhance visibility and awareness, particularly for vulnerable road users such as pedestrians and cyclists.

Health and Safety Protocols

- Establish comprehensive health and safety training for all construction workers, emphasizing safe driving, equipment operation, and emergency response procedures.
- Implement regular monitoring of air quality and noise levels around the construction site. If levels exceed regulatory limits, appropriate measures should be taken to reduce emissions, such as using noise barriers or dust suppression techniques.

Community Engagement Initiatives

- Conduct regular community meetings to keep residents informed about construction schedules, potential impacts, safety measures being implemented, as well as any crossings made available to them.
- Create a feedback mechanism for residents to report concerns or incidents related to construction activities, with a response plan in place to address these issues promptly.
- Health and safety risks in the vicinity of all Project components and associated facilities (when determined) should be publicly disclosed to settlements in the area, with clear directions communicated, and signs and fencing erected for hazardous areas.
- Develop and enforce a strict code of conduct for security personnel to ensure they engage respectfully and appropriately with community members. Supplement with training on human rights and conflict de-escalation.

- Engage local stakeholders in discussions regarding security needs to ensure alignment with community expectations and to avoid unnecessary escalation of tensions**.**
- Facilitate healthcare access for the local population by coordinating with local health services to prepare for increased demand. This may include temporary health clinics or mobile health units for direct service provision to vulnerable groups.
- Implement vaccination and health screenings for construction workers to mitigate the risk of infectious disease spread. Healthcare providers should also promote best practices to reduce transmission of diseases.

Gender-Based Violence Prevention Programs

- Implement awareness-raising campaigns focused on gender-based violence (GBV) targeted at both the workforce and the local community. These campaigns should inform all individuals of available services and resources.
- Embed Gender-Based Violence and Harassment (GBVH) awareness and prevention within the worker induction briefings (including contractors and subcontractors during the operational and construction phases) by outlining the Code of Conduct, which should explicitly include the prohibition of GBVH and any form of harassment, discrimination, or inappropriate behaviour. Establish referral networks with local NGOs or service providers that specialise in addressing GBV, ensuring that affected individuals have safe access to support services.

Monitoring and Reporting

- Establish a robust monitoring and evaluation framework to continuously assess the impacts of construction activities on health and safety. This should include regular reporting on incidents, health outcomes, and community concerns.
- Conduct post-construction assessments to evaluate the long-term effects of the Project on community health and safety, and to adapt mitigation measures as needed for future phases.

7.7.3.5 SUMMARY

The additional mitigation measures proposed will lower the **overall impact significance to Minor to Moderate. Table 7-47** summarises the negative impacts on community health and safety during the construction phase of the Project.

TABLE 7-47: IMPACT SIGNIFICANCE ON COMMUNITY HEALTH AND SAFETY (CONSTRUCTION)

Assessment of Community Health and Safety during Construction				
Potential Impact	Impacts due to transport and construction-related activities; impacts due to in-migration of workers			
Project Phase	Pre-construction	**Construction**		Operation
Impact Nature	**Negative**	Positive		Neutral
Impact Type	**Direct**	Indirect		Induced
Impact Duration	Temporary	**Short-term**	Long-term	Permanent
Impact Extent	**Local**	Regional		International
Impact Scale	Widespread within the SAoI due to multiple sources of impact (e.g., traffic, noise, influx of workers).			

Assessment of Community Health and Safety during Construction					
Frequency	Continuous throughout the construction phase.				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Receptor Sensitivity	Low	**Medium**	High		
Impact Significance	Negligible	Minor	**Moderate**	Major	
Residual Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
Residual Receptor Sensitivity	Low	**Medium**	High		
Residual Impact Significance	Positive	Negligible	**Minor**	Moderate	Major

7.8 ASSESSMENT OF IMPACTS DURING THE OPERATIONAL PHASE

This section assesses the potential social impacts associated with economic and employment opportunities, community health and safety, as well as labour conditions due to construction activities for the Project.

7.8.1 ECONOMIC AND EMPLOYMENT OPPORTUNITIES

7.8.1.1 POTENTIAL AND/OR EXISTING IMPACTS

Opportunities for direct employment in railway operations and maintenance

- The operational phase is anticipated to provide ongoing jobs for local residents in railway operations and maintenance, contributing to sustained employment in the area. The construction phase is expected to create about 600 jobs directly related to railway operations, contributing to local employment rates.

Indirect economic opportunities through rail activity

- Increased rail operations can stimulate local economies by supporting transportation-related businesses, retail, and service industries that cater to passengers and freight haulers**.**

National and regional economic growth due to increased freight volume

- The operational capacity of the railway is expected to facilitate higher freight volumes, resulting in increased government revenue through taxation and stimulating economic activity within the regional economy. For instance, the Akim of Kazybek Bek identified the Project to be one that was pivotal in the region attracting further investments, citing the new industrial zone and a Special Economic Zone (SEZ) which will begin construction once the rail is operational. This is as the rail operations will increase accessibility for passenger and cargo transport, fostering regional development and contributing positively to the connectivity of region.
- Respondents surveyed by ERM shared their anticipation that the increase in tax revenue will drive the development of infrastructure for the Almaty region, thereby driving economic development and creating jobs indirectly.

Increased accessibility for cargo transport

The operational phase of the Project will improve **accessibility for cargo transport**, significantly enhancing connectivity within the region. For cargo, the railway's expanded capacity will streamline the transport of goods, reducing logistics costs and enhancing supply chain efficiency. This improvement is critical for businesses relying on the timely movement of goods, boosting regional competitiveness and fostering economic opportunities tied to trade and commerce.

7.8.1.2 ASSESSMENT OF IMPACT SIGNIFICANCE

It is expected that the Project's operations will have a generally **positive** impact significance on employment and opportunities for residents within the SAoI and the broader national economy within Kazakhstan. No impact magnitude is assigned.

7.8.1.3 SUMMARY

The assessment of **positive** social impacts on economic opportunities and employment is summarised below.

TABLE 7-48: IMPACT SIGNIFICANCE ON ECONOMIC AND EMPLOYMENT OPPORTUNITIES

<table>
<tr><th colspan="7">Assessment of Economic Impacts and Opportunities During Operations</th></tr>
<tr><td>Potential Impact</td><td colspan="6">Opportunities for direct employment in railway operations.
Indirect opportunities created through opportunities created by rail activity e.g. small businesses.
National and regional economic growth due to increased freight volume and associated government revenue through taxation.
Increased accessibility for cargo transport</td></tr>
<tr><td>Project Phase</td><td colspan="2">Pre-construction</td><td colspan="2">Construction</td><td colspan="2">Operation</td></tr>
<tr><td>Impact Nature</td><td colspan="2">Negative</td><td colspan="2">Positive</td><td colspan="2">Neutral</td></tr>
<tr><td>Impact Type</td><td colspan="2">Direct</td><td colspan="2">Indirect</td><td colspan="2">Induced</td></tr>
<tr><td>Impact Magnitude</td><td>Positive</td><td>Negligible</td><td>Small</td><td>Medium</td><td colspan="2">Large</td></tr>
</table>

7.8.2 LABOUR AND WORKING CONDITIONS

7.8.2.1 POTENTIAL OCCUPATIONAL HEALTH AND SAFETY RISKS FOR WORKERS

Workers involved in railway operations may face occupational health and safety challenges, including those linked to equipment operation and exposure to hazardous materials or conditions. Some of the potential risks include:

- **Collision and derailment risks:**

  Workers involved in train operation and maintenance may face risks of train collisions due to human **error**, technical failures, or adverse weather conditions. Derailment incidents are generally rare but pose significant risks of injury and death to staff on board and maintenance staff.

- **Fatigue from train operations:**

  Long shifts and irregular schedules can lead to operator fatigue, increasing the likelihood of errors impacting the health and safety of operators and other rail workers.

- **Exposure to adverse weather conditions:**

  Maintenance teams often work in harsh outdoor environments, increasing risks of heat exhaustion, hypothermia, or other weather-related conditions.

- **Equipment-related injuries:**

  Heavy machinery or power tools used in track maintenance, if used improperly, can lead to injuries such as crush injuries, lacerations and electrical shock.

- **Noise and vibration exposure:**

  Prolonged exposure to high levels of noise from the operations of the Project such as moving trains, engines and machinery can lead to occupational hearing loss. Vibrating machinery, when handled over long periods of time, can lead to musculoskeletal disorders for workers.

- **Chemical and material hazards:**

  Workers involved in the transport of dangerous goods (e.g., chemicals, fuels) are at risk of exposure during spills, leaks, or accidents. Dust generated during cargo handling or track maintenance can lead to respiratory problems, especially for workers who are exposed over extended periods of time.

- **Ergonomic and physical strain:**

  Workers performing repetitive lifting, carrying, or pushing tasks may suffer from musculoskeletal injuries. There may also be slip, trip and fall hazards which workers are more highly exposed to, increasing the likelihood of accidents especially if surfaces are poorly maintained, or lighting conditions are inadequate.

7.8.2.2 EMBEDDED CONTROLS

- The Labour Code mandates sector-specific OHS standards for hazardous industries, including railways. Employers must establish safety protocols, conduct periodic risk assessments, and mitigate physical hazards like noise, vibration, and ergonomic strains.

7.8.2.3 ASSESSMENT OF IMPACT SIGNIFICANCE

Impact Magnitude: Medium

- While the operation of the railway introduces risks, the Project has implemented some safety measures and protocols to mitigate these impacts, as documented in the Project's operational health and safety plan.
- According to workers interviewed by ERM, safety measures are perceived as adequate, and no major accidents have occurred thus far.

Receptor Sensitivity: Medium

- Workers, especially temporary or vulnerable workers, have limited ability to adapt to the occupational health and safety risks, especially if they are dependent on the Project's employment for their livelihoods.
- Persistent exposure to occupational hazards during the operations phase can lead to long-term physical or economic impacts.

The impact significance is assessed to be Moderate.

7.8.2.4 MITIGATION MEASURES

Align the Project's operational health and safety plan with measures outlined in the Occupational Health and Safety Management Plan documented in the Environmental Social management System. The key measures include:

- Hazard Control:
  - Use of PPE, proper lighting, site demarcation, and lifting plans for heavy equipment.
- Workplace Safety:
  - Manual handling training to prevent injuries.
  - Fall protection for work at heights.
  - Safe excavation practices to avoid utility damage.
- Permit-to-Work (PTW):
  - Controls hazardous activities (e.g., hot work, electrical work, confined spaces).
- Emergency Preparedness:
  - Monthly mock drills, fire safety checks, and emergency procedure displays.
- Vehicle and Equipment Safety:
  - Regular maintenance, speed control, seatbelt use, and fire extinguishers in vehicles.
- Occupational Health and Safety Training:
  - Worker inductions, daily toolbox talks, and task-specific safety training (e.g., welding, electrical work).
- Worker Wellbeing:
  - Rest shelters, drinking water, and heat stress precautions.
- Monitoring:
  - Regular OHS inspections, weekly/monthly safety meetings, and reporting of incidents.

7.8.2.5 SUMMARY

With the implementation of the mitigation measures, the residual impact magnitude is lowered to small, and **the residual impact significance is assessed to be Minor.**

TABLE 7-49: IMPACT SIGNIFICANCE ON LABOUR AND WORKING CONDITIONS DURING OPERATION

Assessment of Impacts on Labour and Working Conditions During Operation				
Potential Impact	• Exposure to moving trains, high voltage electricity, prolonged exposure to noise and dust and prolonged working hours including night shifts due to operational needs of the Project, leading to heightened health and safety risks to workers.			
Project Phase	Pre-construction	Construction	**Operation**	
Impact Nature	**Negative**	Positive	Neutral	
Impact Type	**Direct**	Indirect	Induced	
Impact Duration	Temporary	Short-term	**Long-term**	Permanent
Impact Extent	**Local**	Regional	International	
Impact Scale	Moderate, with potential for significant incidents if not properly managed.			

Assessment of Impacts on Labour and Working Conditions During Operation					
Frequency	Continuous during operations, with potential for occasional incidents.				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Receptor Sensitivity	Low		**Medium**		High
Impact Significance	Positive	Negligible	Minor	**Moderate**	Major
Residual Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
Residual Receptor Sensitivity	Low		**Medium**		High
Residual Impact Significance	Positive	Negligible	**Minor**	Moderate	Major

7.8.3 COMMUNITY HEALTH AND SAFETY

During the operational phase of the Almaty Bypass Railway Project, specific community health and safety concerns may arise, particularly related to increased rail activity and its interaction with local communities.

7.8.3.1 POTENTIAL IMPACTS

Increased risk of traffic accidents due to rail activity

The operational phase may lead to a higher likelihood of accidents involving trains and road users at level crossings, which could result in injuries or loss of life. The operation of the railway introduces potential hazards at level crossings, where trains intersect with roadways. These intersections can become sites for accidents involving trains and road users, leading to possible injuries or fatalities.

Increased exposure to noise and vibrations for settlements along the alignment

The continuous operation of the railway may result in sustained noise levels that could impact community health and safety, particularly for settlements located near the rail corridor. Prolonged exposure to elevated noise levels can contribute to sleep disturbances, increased stress levels, and potential cardiovascular issues, particularly among vulnerable groups such as the elderly, children, and those with pre-existing health conditions. In addition to health effects, noise pollution can also reduce overall community well-being, disrupt daily activities, and impact livestock and agricultural productivity in rural areas.

Security arrangements for railway

Given that railway infrastructure is strategically important, security measures will very likely be in place during operations. While information on security arrangements during the operational phase was not yet available at the time of writing, it is likely that security personnel will be deployed at stations, and in cases such as the transport of precious cargo. Given the likely presence of security personnel, there is a risk of conflicts and/or community tensions, especially if excessive or inappropriate security measures are taken (e.g. excessive use of force).

7.8.3.2 EMBEDDED CONTROLS

- From the available information, there has thus far been no traffic management plan and security management plan created by KTZ.
- There are several embedded controls in order to reduce operational noise impacts. They include:
- Train Speed Adjustment – Train speeds will be strategically reduced near sensitive receptors to minimize noise exposure. The train operates at an average speed of 60 km/h, slowing to 40 km/h within 1.5 km of stations and further reducing to 20 km/h when approaching stations.
- Track Design for Noise and Vibration Reduction – The railway incorporates 30 cm of gravel and sand ballast, which helps absorb and dissipate vibrations, minimizing ground-borne noise that could impact nearby buildings and communities.
- Regular Maintenance – Annual rail track inspections and maintenance will ensure smooth surfaces and proper wheel alignment, reducing operational noise and vibration impacts over time.

7.8.3.3 ASSESSMENT OF IMPACT SIGNIFICANCE

The assessment of the significance of impacts in relation to community health and safety during the operations phase is based on the criteria set out in **Section 5.**

Impact Magnitude: Medium

Risk of traffic accidents:

- While accidents at level crossings can result in serious injuries or fatalities, such incidents are likely to be localised rather than widespread. The position of the alignment is such that accidents (if any) will likely be localised to the station areas at Zhetygen and Kazybek Bek, due to the proximity to residential settlements.
- The likelihood of accidents depends on road user behaviour, train schedules, and the presence of warning signals or barriers. While no Traffic Management Plan was made available, KTZ implements standard rail safety protocols (e.g., horn warnings, light signals, visibility of trains) which provide some level of risk mitigation.

Noise exposure:

- The embedded control measures reduce impact intensity, preventing the magnitude from being classified as high.
- Similar to the risk of traffic accidents, the noise impacts are likely to be localised to the settlements at Zhetygen and Kazybek Bek.

Receptor Sensitivity: Medium

- Communities near level crossings are particularly vulnerable to rail-related traffic accidents. Without proper traffic management measures such as signalization, barriers, and public awareness campaigns, these crossings may become high-risk areas.
- Vulnerable groups (elderly, children, individuals with existing health conditions) are more susceptible to the adverse health effects of prolonged noise and vibration exposure.

The impact significance is assessed to be Moderate.

7.8.3.4 MITIGATION MEASURES

The EHS Guidelines for Railways suggest the following:

- Emergency Response Planning: Developing and implementing a Traffic Management Plan that includes barriers, warning signals and public awareness measures to minimise rail-related accident risks and ensuring community safety throughout the operational phase (refer to the **Environmental and Social Management System**).
- Community Engagement: Involving local communities in planning processes to ensure that their needs and concerns are addressed, and to foster collaboration in mitigating potential impacts (refer to the **Stakeholder Engagement Plan**).
- Security Management: Develop and implement a Security Management Plan that is in line with IFC PS4, guided by the principles of proportionality, risk-based approach, accountability, good international industry practice, and respect for human rights, particularly in relation to the hiring, rules of conduct, training, equipping, and monitoring of security personnel.

Beyond the immediate risks, the EHS Guidelines for Railways highlight other community health and safety aspects that should be considered:

- Hazardous Materials Transport: If the railway is used to transport hazardous materials, there is a potential risk of spills or accidents that could harm the community. Strict adherence to safety protocols and regular training for personnel can mitigate these risks.
- No risks or impacts on the use of hazardous materials were considered as KTZ and Integra confirmed that no hazardous materials are anticipated to be transported during the operations phase. Should there be any future changes in material use or transport that involve hazardous substances, a Hazardous Materials Management Plan should be developed in line with IFC EHS Guidelines to ensure appropriate handling, storage, and disposal procedures.

7.8.3.5 SUMMARY

With the implementation of the mitigation measures, the residual impact magnitude is lowered to small, and **the residual impact significance is assessed to be Minor.**

TABLE 7-50: IMPACT SIGNIFICANCE ON COMMUNITY HEALTH AND SAFETY DURING OPERATION

<table>
<tr><th colspan="5">Assessment of Impacts on Community Health and Safety During Operations</th></tr>
<tr><td>Potential Impact</td><td colspan="4">• Increased risk of traffic accidents
• Increased strain on public services
• Noise and vibration causing nuisance
• Transport risks related to hazardous materials (if any)</td></tr>
<tr><td>Project Phase</td><td>Pre-construction</td><td colspan="2">Construction</td><td>Operation</td></tr>
<tr><td>Impact Nature</td><td>Negative</td><td colspan="2">Positive</td><td>Neutral</td></tr>
<tr><td>Impact Type</td><td>Direct</td><td colspan="2">Indirect</td><td>Induced</td></tr>
<tr><td>Impact Duration</td><td>Temporary</td><td>Short-term</td><td>Long-term</td><td>Permanent</td></tr>
<tr><td>Impact Extent</td><td>Local</td><td colspan="2">Regional</td><td>International</td></tr>
<tr><td>Impact Scale</td><td colspan="4">Moderate, with potential for significant incidents if not properly managed.</td></tr>
<tr><td>Frequency</td><td colspan="4">Continuous during operations, with potential for occasional incidents.</td></tr>
</table>

Assessment of Impacts on Community Health and Safety During Operations					
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Receptor Sensitivity	Low	**Medium**	High		
Impact Significance	Positive	Negligible	Minor	**Moderate**	Major
Residual Impact Magnitude	Positive	Negligible	**Small**	Medium	Large
Residual Receptor Sensitivity	**Low**	**Medium**	High		
Residual Impact Significance	Positive	Negligible	**Minor**	Moderate	Major

7.8.4 GENDER-DIFFERENTIATED IMPACTS ON WOMEN

The Project's land acquisition, construction and operations phases may have gender-differentiated impacts that disproportionately affect women, particularly in vulnerable groups such as women-headed households and low-income families. These impacts arise due to traditional gender roles, economic disparities, contextual risks such as the prevalence of gender-based violence in Kazakhstan and safety-related concerns.

7.8.4.1 POTENTIAL AND/OR EXISTING IMPACTS ON WOMEN

Women, particularly in agricultural households, are indirectly impacted when land-based livelihoods are disrupted. Traditional gender roles in such households often assign women responsibilities for subsistence farming, food production, and household management, while men may focus on industrial employment or livestock rearing. The loss of communal grazing lands or agricultural (including livestock grazing) areas can lead to the following gender-specific impacts:

- Increased Workload:
  With reduced access to communal grazing lands or farmland, women may need to travel further to access resources such as firewood, water, or alternative grazing areas, increasing their time and labour burden.
- Food Security Concerns:
  Women's role in food production and subsistence farming may be disrupted if access to arable land is lost, impacting household food supply and nutrition.
- Reduced Household Income:
  If men's livestock activities are affected due to limited grazing, women may face greater financial strain to compensate through additional informal work or cost-cutting measures.
- Emotional and Social Stress:
  Disruption to livelihoods may increase women's stress as they navigate their dual role as caretakers and resource managers while adapting to the changes in household income and food production.
- Induced Impacts on Gender-Based Violence:
  As mentioned in the social baseline, gender-based violence is a critical issue in Kazakhstan. According to respondents surveyed by ERM, domestic violence is attributed to several vulnerabilities in a household: for example, single-parent families and alcoholism/substance abuse were quoted as correlated factors. There is a risk that

negative economic impacts of the Project may induce an increase in gender-based violence.

Women-headed households face greater challenges in adapting to the loss of land or displacement as they may have limited financial resources or access to alternative livelihoods

- Economic Vulnerability:
  Women-headed households may have fewer income-generating opportunities, making it harder to recover from the loss of agricultural land or grazing resources, which are critical for subsistence and livelihoods.
- Increased Labour Burden:
  Women managing households alone may face additional responsibilities in finding alternative resources, such as land, water, or fuel, which can exacerbate their already significant time and labour demands.
- Food Insecurity:
  With reduced land access, food production and subsistence farming are disrupted, increasing the risk of food insecurity for women-headed households that rely heavily on these resources for survival.
- Safety Concerns:
  Women may face increased risks of gender-based violence (GBV) and harassment while traveling longer distances to access resources or alternative livelihood opportunities.

During the operational phase of the Project, gendered impacts are primarily associated with the sustained effects of land acquisition, community dynamics around railway operations, and opportunities or challenges presented by employment and economic activities. The following potential impacts on women have been identified:

- Limited Access to Employment Opportunities for Women:
  Railway operations typically employ more men due to technical and operational skill requirements, potentially leaving women with fewer opportunities for direct employment in this phase. Indirect economic opportunities (e.g., catering, cleaning, or service-based jobs) may be available but limited in scope, particularly for women in rural areas.
- Safety Risks Associated with Increased Rail Traffic:
  Women and children may face increased risks when crossing railway lines, particularly in areas where crossings are insufficient or unsafe. Night-time operations and isolated railway infrastructure may raise safety concerns for women, including risks of harassment or violence in poorly lit areas.
- Increased mobility:

  In a rural context, the Project's rail infrastructure and anticipated induced infrastructural developments due to the increased connectivity of the area brings about increased mobility for women. This can lead to women having improved access to educational institutions, healthcare facilities, and markets, enabling better participation in socio-economic activities.

7.8.4.2 EMBEDDED CONTROLS

- There are no known project-specific embedded controls with a focus on gendered impacts on women.

- The Project relies on national legislation to address such concerns. Notably, in April 2024, Kazakhstan's President Kassym-Jomart Tokayev signed a law criminalising domestic violence, reinstating battery and light bodily harm as criminal offenses, which had been decriminalized in 2017. Consultations with women in the community indicated that most were aware of the recent passing of this legislation criminalising domestic violence in Kazakhstan and cited it as an improving situation for women in general due to the increased legal protections that victims are entitled to. This awareness reflects the law's significant public attention, partly due to high-profile cases and national discussions on the issue.
- Safety and traffic related management policies and considerations are gender-agnostic.

7.8.4.3 ASSESSMENT OF IMPACT SIGNIFICANCE

Impact Magnitude: Medium

- The loss of agricultural lands for grazing and crop farming (or the use of them) directly affects women’s workload, food security, and household income. These impacts are localized to affected households within the Project’s footprint but significant for those directly reliant on these resources.
- Women-headed households, in particular, are disproportionately affected due to limited financial resources and access to alternative livelihoods.
- Changes are not permanent, as alternative resources or income-generating opportunities can potentially mitigate these impacts.

Receptor Sensitivity: Medium

- Women in rural agricultural households and women-headed households are vulnerable to these impacts due to traditional roles, limited financial resources, and reduced adaptive capacity.
- However, this is abated to some extent by the national legal protections afforded to women and the increasing focus on autonomy and self-care in younger generations of women in Kazakhstan as suggested by focus group discussion respondents.

The combination of medium impact magnitude and medium receptor sensitivity results in an **overall assessment of Moderate impact significance**. This reflects that while impacts are significant, they are mitigable through well-designed interventions.

7.8.4.4 MITIGATION MEASURES

- Provide targeted livelihood restoration programs for women in alignment with the guidance set out in the Livelihood Restoration Plan. This may include financial literacy training, access to microloans, and skill development workshops.
- Ensure that vulnerable groups which are disproportionately impacted such as women-headed households receive tailored assistance such as additional financial aid or entrepreneurial support for sustainable livelihoods, or as set out in the Livelihood Restoration Plan.
- Establish clear codes of conduct for workers (for both operation and construction phases) with zero-tolerance policies for GBV, harassment, and exploitation. Communicate and cascade policies down to contractors and subcontractors.

- Establish specific hiring quotas or outreach programs to encourage women to apply for operational roles, particularly in non-traditional sectors such as engineering and operations.
- Ensure the GRM is gender-sensitive and accessible, with provisions for confidential reporting and resolution of gender-specific grievances.
- Provide well-lit and safe pedestrian crossings, particularly in areas frequently used by women and children. Further consultations with women and local authorities may be required to identify these areas.

7.8.4.5 SUMMARY

When implemented, the mitigation measures will lower the receptor sensitivity to low. **The residual impact significance is assessed as Minor.**

TABLE 7-51: IMPACT SIGNIFICANCE ON GENDERED IMPACTS ON WOMEN

Assessment of Gendered Impacts on Women					
Potential Impact	• Increased workload and economic vulnerability • Food security and financial strain • Gender-based violence risks • Safety concerns and gender disparities in employment				
Project Phase	**Pre-construction**		**Construction**	**Operation**	
Impact Nature	**Negative**		Positive	Neutral	
Impact Type	**Direct**		**Indirect**	**Induced**	
Impact Duration	Temporary	Short-term		**Long-term**	Permanent
Impact Extent	**Local**		Regional	International	
Impact Scale	Local to settlements affected by the Project footprint, and in the vicinity of the Project.				
Frequency	• Impacts relating to the loss of lands are one-time events. • Impacts related to employment are short-term. • Impacts relating to rail traffic and safety are continuous throughout the operational phase. • Risks of harassment or gender-based violence are periodic and dependent on the frequency of interaction.				
Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Receptor Sensitivity	Low		**Medium**	High	
Impact Significance	Positive	Negligible	Minor	**Moderate**	Major
Residual Impact Magnitude	Positive	Negligible	Small	**Medium**	Large
Residual Receptor Sensitivity	**Low**		Medium	High	
Residual Impact Significance	Positive	Negligible	**Minor**	Moderate	Major

7.9 SUMMARY OF SOCIAL AND SOCIOECONOMIC IMPACTS

The following table presents a summary of social and socio-economic impacts with pre- and post-mitigation impact significances.

TABLE 7-52: SUMMARY OF SOCIAL AND SOCIO-ECONOMIC IMPACT ASSESSSMENT

Impact/Risk	Pre-Mitigation Impact		Post-Mitigation (Residual Impact)	
	Significance	**Magnitude**	**Significance**	**Magnitude**
Pre-construction/Planning Phase				
Physical displacement of landowners and users	Moderate	Medium	Minor	Small to Medium
Economic displacement of landowners	Moderate	Medium	Minor	Medium
Economic displacement of land users	Moderate	Medium	Minor	Medium
Economic displacement impacts on commercial entities	Moderate	Medium	Minor	Small
Workers facing loss of employment due to land acquisition	Moderate	Medium	Minor	Medium
Loss of communal grazing lands and disruption of household or community activities	Minor	Small	Negligible	Negligible
Construction Phase				
Economic and employment opportunities	Positive			
Labour and working conditions	Minor	Small	Negligible	Small
Community health and safety	Moderate	Medium	Minor	Small
Operational Phase				
Economic and employment opportunities	Positive			
Labour and working conditions	Moderate	Medium	Minor	Small
Community health and safety	Moderate	Medium	Minor	Medium
Throughout the Pre-Construction, Construction and Operational Phase				
Gendered impacts on women, including risks of gender-based violence	Moderate	Medium	Minor	Medium

7.10 CULTURAL HERITAGE

7.10.1 LEGISLATION AND ASSESSMENT FRAMEWORK

This assessment has been prepared in accordance with the following leading practice guidelines and treaties, as well as the national statutory framework of Kazakhstan outlined in **Table 7-53.**

TABLE 7-53: CULTURAL HERITAGE APPLICABLE REGULATIONS AND GUIDELINES

Title	Year
Law	
Environmental Code of the Republic of Kazakhstan No. 212.	2007
Law on Culture of the Republic of Kazakhstan No. 207 (as amended by No. 446-V in 2016).	2006
Law on Protection and Use of Objects of Historical and Cultural Heritage of the Republic of Kazakhstan No. 1488-XII (as amended by No. 479-V in 2016).	1992
"On the protection and use of historical and cultural heritage sites", Law of the Republic of Kazakhstan dated 26 December 2019 № 288-VI ЗРК.	2019
"On approval of the Rules for determining the protection zone, the zone for regulation of development and the zone of the protected natural landscape of the monument of history and culture and the regime for their use", Order of the Minister of Culture and Sports of the Republic of Kazakhstan dated 14 April 2020 No. 86. Registered with the Ministry of Justice of the Republic of Kazakhstan on 15 April 2020 № 20395.	2020
Policy	
UNESCO Convention concerning the Protection of the World Cultural and Natural Heritage.	1994
UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage.	2012
IFC Environmental and Social Performance Standards (PS).	2012
IFC Guidance Note 8: Cultural Heritage.	2012

7.10.1.1 IFC PS8: CULTURAL HERITAGE

IFC PS8 emphasizes the importance of safeguarding both tangible and intangible forms of cultural heritage during project design and execution. Tangible cultural heritage includes movable and immovable objects, archaeological sites, and structures with historical, cultural, or artistic significance. Intangible heritage covers cultural knowledge and practices tied to traditional lifestyles. The key objectives of IFC PS8 include:

- To protect cultural heritage from the adverse impacts of project activities and support its preservation.
- To promote the equitable sharing of benefits from the use of cultural heritage.

The scope of application for IFC PS8 includes:

- Clients to incorporate considerations of cultural heritage into their Environmental and Social Management System (ESMS) from the onset of project planning.
- Cultural heritage is defined to include tangible elements (like historic sites and artifacts), unique natural features (such as sacred groves), and certain intangible cultural aspects (like traditional knowledge).
- The application of the standard, irrespective of legal protections and does not extend to Indigenous Peoples' cultural heritage, which is covered under a separate standard.

7.10.1.2 APPLICATION OF KEY NATIONAL LEGISLATION

On the Protection and Use of Historical and Cultural Sites - Law of the Republic of Kazakhstan 2019

The "On the protection and use of historical and cultural sites - Law of the Republic of Kazakhstan dated 26 December 2019" law describes the framework for the protection and use of historical and cultural heritage sites in the Republic of Kazakhstan. It outlines the purpose, objectives, and legal regulations associated with these efforts. Specifically, the law aims to ensure the revival, preservation, and popularisation of historical and cultural heritage sites.

Monuments of historical and cultural heritage in Kazakhstan can be categorised on their significance, which is as followed:

1. **Local Significance**: These monuments have importance primarily within a specific locality, such as a city or region. They reflect the history and culture of that area.
2. **National (Republican) Significance**: These monuments hold importance for the entire nation of Kazakhstan. They may relate to key historical events, notable figures, or shared cultural heritage that is recognised across the country.
3. **International Significance**: Monuments classified with international significance have value that extends beyond national boundaries. They are recognised for their contributions to global cultural heritage and may be candidates for listings such as UNESCO World Heritage status.

The law also outlines the process regarding the State List of Historical and Cultural Monuments, which includes the approval criteria, ensuring formal recognition, the registration process, and the criteria for inclusion in the State List. Importantly, of direct relevance to this project, this law applies to the discovery of 'Valuable Objects' and outlines the procedure for notification of an unexpected ('chance') find.

Determining the Protection Zone, Zone for Regulation of Development and Zone of the Protected Natural Landscape - Order of the Minister of Culture and Sports of the Republic of Kazakhstan 2020

The "Rules for determining the protection zone, the zone for regulation of development and the zone of the protected natural landscape of the monument of history and culture and the regime for their use", in the Order of the Minister of Culture and Sports of the Republic of Kazakhstan dated 14 April 2020 No. 86, establishes the rules for determining the protection zone, the zone for regulating the development and the zone of the protected natural landscape of a historical and cultural monument and the mode of their use.

The Order states that, to ensure the safety and historical integrity, for the protected zone of a monument of historical and cultural significance, economic activity and construction shall be prohibited, except for the use of special measures aimed at preserving the monument. Furthermore, it states that new construction work shall not be carried out in the security zone. It emphasizes that the protection zone of the historical and cultural monument shall be marked by security signs or an open strip, or fences, or shrub plantations along their borders.

I. Determining the protection zone

The boundaries of protected zones are directly relevant to the Project. Based on the Order No. 86 by the Minister of Culture and Sports of the Republic of Kazakhstan, the methodology for determining the boundaries of **protected zones** shall be calculated for the following:

1. *A monument of town planning and architecture, the construction of monumental art, sacred objects up to 40m high shall be surrounded by a security zone equal to two values of the distance from the ground to its highest point.*
2. *A monument of town planning and architecture, the construction of monumental art, sacred objects with a height of 40m shall be surrounded by a security zone equal to one distance from the ground to its highest point.*
3. *A monument of archaeology, **sacred objects** shall be surrounded by a protected zone of 40m from the extreme boundaries of the detection of cultural layers of a historical and cultural monument, with a group of monuments - from the external extreme boundaries of historical and cultural monuments.*
4. *Ensembles and complexes, sacred objects shall be surrounded by a security zone of 20m from the boundaries of the extreme object of the monument of history and culture.*

Note: Cultural heritage objects of mounds and burial grounds of the Iron Age shall be considered sacred objects, and shall be protected by a protection zone of 40m.

II. <u>Determining the zone for regulation of development</u>

The **zone for regulating the development** of a historical and cultural monument shall be determined equal to one size of the protected zone. The development regulation zone of the historical and cultural monument shall be fixed from the edge of the protected zone of the historical and cultural monument.

Note: The zone for regulating the development of historical and cultural monument shall be equal to one size of the protected zone of 40m, and thus, should also be of 40m.

III. <u>Determining the zone of the protected natural landscape</u>

The **zone of the protected natural landscape** of the historical and cultural monument shall be determined equal to the size of the development regulation zone. The protected natural landscape zone shall be fixed from the edge of the building control zone.

Note: The zone for the protected natural landscape shall be equal to one size of the development regulation zone of 40m, and thus, should also be of 40m.

IV. <u>Determining the total zone of protection for sacred objects of critical cultural heritage</u>

The total boundary of the protection zone for sacred objects cultural heritage, such as mounds and burial grounds of the Iron Age shall be, as per the Order of the Minister of Culture and Sports of the Republic of Kazakhstan dated 14 April 2020 No. 86, on the “rules for determining the protection zone, the zone for regulation of constructions and the zone of the protected natural landscape of the monument of history and culture and the regime for their use”, equal to a minimum of 120m, which refers to 40m protection zone + 40m zone for regulating the development + 40m for the zone of the protected natural landscape.

7.10.2 EARLY-STAGE CONDITIONS

To understand the presence of cultural heritage site prior to the Projects commencement, the following resource were reviewed:

- Review of National EIA, Section 17.7 "Tangible assets, objects of historical and cultural heritage (including architectural and archaeological), landscapes", which had used studies undertaken by Antique-KZ.
- Review of previous assessments:
  - Letter No. 54/20-381, dated 3 December 2014 from Margulan Institute of Archaeology.
  - Letter No. AE-2023/003, dated 27 March 2023 from Antique-KZ.
  - Letter No. 54/20-480, dated 01 November 2024 from Margulan Institute of Archaeology.
- Consultation through Key Informant Interviews (KIIs) with Poligram and Margulan Institute of Archaeology representatives.
- Field survey report by consulting archaeologists (Margulan University Institute of Archaeology) done in 2014 and 2024, and site visit by ERM on 30 October 2024.

Three (3) Cultural Heritage assets along the surveyed corridor were identified by the Margulan Institute of Archaeology in 2014.

7.10.2.1 NATIONAL EIA – ANTIQUE-KZ

The study done by Antique-KZ in 2023, which was included in the National EIA, has been excluded from the Supplementary ESIA based discussions with the Project Proponent regarding data coordinate inconsistencies.

7.10.2.2 FINDINGS BY THE MARGULAN INSTITUTE OF ARCHAEOLOGY

Letter No. 54/20-381, dated 3 December 2014 from Margulan Institute of Archaeology

The study was conducted for a length of 68km, from the sections between Zhetygen and Uzynagash. The study concludes that there are 3 (three) archaeological sites associated with the remains of the late period of the early Iron Age. The study finds that the closest site is located approximately 200m from the centreline.

Letter No. 54/20-480, dated 1 November 2024 from Margulan Institute of Archaeology

The study was conducted in the territorial lands of Zhambyl, Karasay, and Iliy Districts of Almaty Region, and is done as a response to a letter received from KTZ on 24 October 2024 on "Guidelines for the implementation of large projects". The letter requested confirm the relevance of the historical-cultural conclusion study №54/20-381 dated 3 December 2014. The request submitted to Margulan also contained Antique-KZ's assessment in 2023.

For this purpose, Margulan conducted a repeated survey (spot survey) to the coordinates that were mentioned in Antique's study, and found that the objects next to the coordinates provided by Antique were not archaeological monuments. The study investigated 120 meters from both sides of the alignment (240 meters CH survey corridor). The construction works, excluding the location of the 14 quarries[308], are carried out within this 240-meter corridor. The location of the closest quarries (N°2 and N°3) does not intersect with the CH site's protection zones (Refer to **Figure 7-15**). The study concluded that there were no objects of historical and

[308] Information of the 14 quarries is shared in Section 2.4 of the Project Requirements, and the geo-referenced location of the 14 quarries provided as an Appendix in the LRP.

cultural heritage on the land plots in the 240-meter survey corridor. Objects outside the survey corridor (120-meter zone from the railway centreline) were not surveyed.

Consultations with Margulan Institute of Archaeology during the Supplementary ESIA

- At the beginning of the Supplementary ESIA, only the letter No. 54/20-381 informing the conclusion of the findings without the detailed findings or associated report was provided for review.
- During the ERM site visit between 28 October – 8 November 2024, ERM received a second letter from Margulan stating that no CH assets or objects were within the 240-meter CH survey corridor (120 meters from the centreline).
- ERM had a key informant interview with Margulan Institute of Archaeology on 7 November 2024 to discuss the content of the letter.
- On 29 November 2024, ERM obtained a copy of their 2014 assessment report with the CH coordinates of the identified archaeological sites.
- During email clarification with Margulan Institute of Archaeology, ERM understood:
    - Margulan's 2014 survey was conducted from the village of Uzynagash to the village of Zhetygen, according to coordinates provided by LLP "InterInzh Almaty", and covering 120 meters from the central line on each side, totalling 240 meters. The survey combined walking and vehicle use where visibility allowed. The survey corridor takes reference from the Order of the Minister of Culture and Sports of the Republic of Kazakhstan No. 86 (2020) regarding the approval of rules for defining protective zones and regulations for historical and cultural monuments.
    - No other historical structures such as modern cemeteries were identified.
    - The 3 (three) archaeological sites are not included in the State List of Historical and Cultural Monuments.

KURGAN EARLY IRON AGE BURIAL GROUNDS

Based on the baseline findings from Margulan Institute of Archaeology, the mounds and burial grounds date to the early Iron Age and are referred to as 'Kurgan' burial grounds. According to online sources, kurgans are mounds of earth and stones raised over a grave or graves[309].

During the survey by Margulan University in 2014, the following objects were identified:

- **Object 1.** The remains of a building and two burial mounds dated to the period of the Early Iron Age. They are located on a natural hill. The mounds are oriented along the line northwest, southeast and constructed of earth and stone.
- **Object 2.** *Kurgan burial ground* consisting of six mounds dated to the Early Iron Age, constructed of earth and stone.
- **Object 3.** *Kurgan burial ground.* It consists of three mounds oriented along the line north-west and south-east constructed of earth and stone.

Table 7-54 identifies the GPS locations and the characteristics of the 3 (three) archaeological sites identified by Margulan Institute for Archaeology in 2014[310].

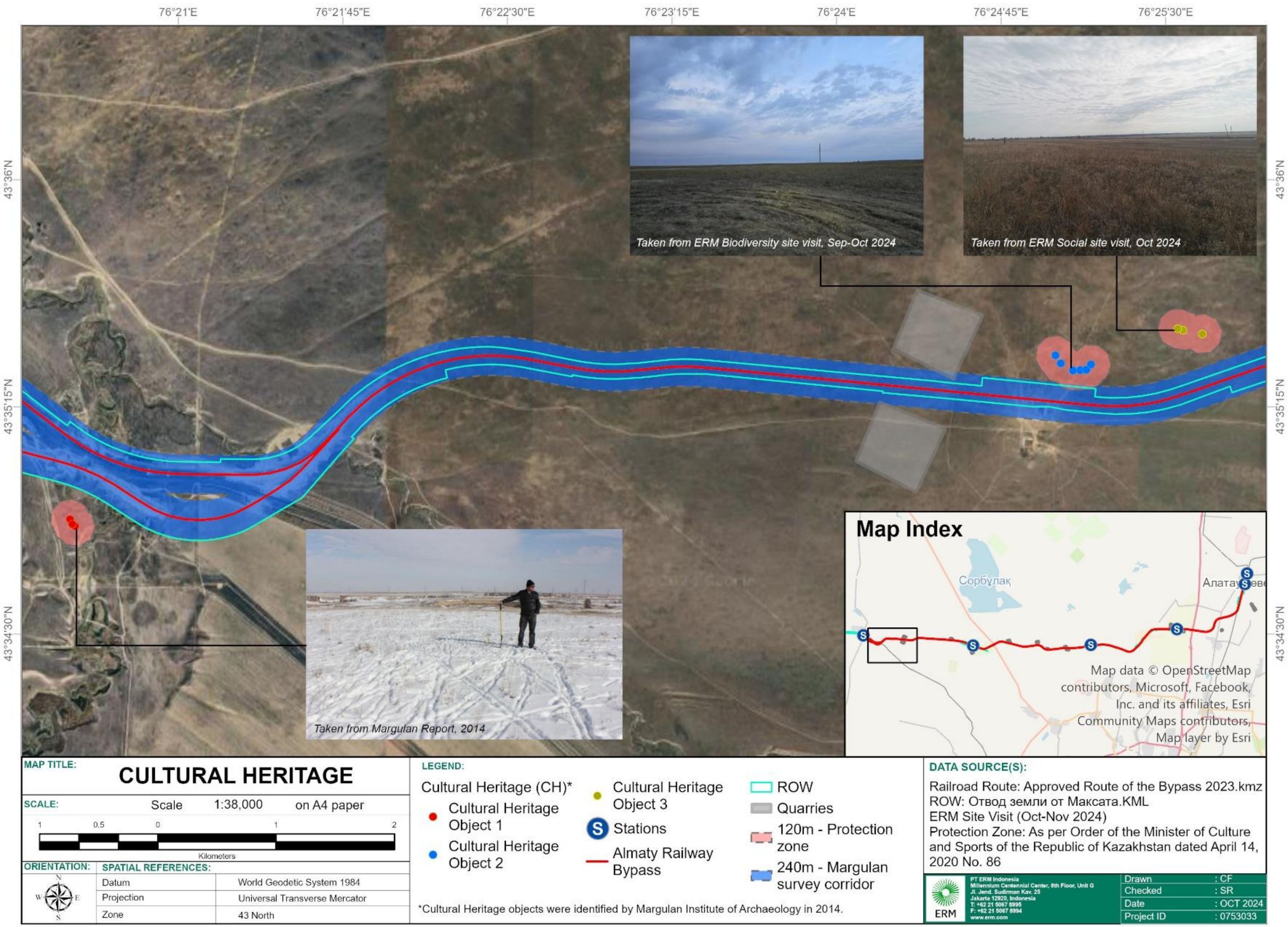
[309] Source: https://en.wikipedia.org/wiki/Kurgan#cite_note-1
[310] Source: Margulan Institute of Archaeology: Conducting an archaeological study of the territory studied for the project "Construction of a bypass railway line bypassing the railway junction of the Almaty station", 2014.

TABLE 7-54: LIST OF IDENTIFIED CULTURAL HERITAGE RESOURCES

Object No.	Cultural Heritage site	Preliminary dating	GPS data	Characteristic
1	Remains of a built structure and two burial mounds.	Early Iron Age	Remains of a later structure: N- 43°34'52.76", E- 76°20'30.43" Mound No 1: N- 43°34'51.36", E- 76°20'31.75" Mound No 2: N- 43°34'51.75", E- 76°20'31.05"	Structure: 7, 4 м (В-З) х 8 м (Ю-С) Kurgan No 1: Diameter 6 m, height 0.1 m Kurgan No 2: Diameter 5.5 m, height 0.1 m
2	Six burial mounds	Early Iron Age	Mound No 1: N - 43°35'22.24", E- 76°25'4.65" Mound No 2: N- 43°35'22.27", E- 76°25'6.62" Mound No 3: N- 43°35'25.19", E- 76°24'59.86" Mound No 4: N- 43°35'23.65", E- 76°25'1.35" Mound No 5: N - 43°35'22.39", E- 76°25'8.25" Kurgan No 6: N - 43°35'23.43", E- 76°25'9.57"	Kurgan No 1: Diameter 10 m, height 0.5 m. Kurgan No 2: Diameter 12 m, height 0.5 m. Kurgan No 3: Diameter 8 m, height 0.4 m. Kurgan No 4: Diameter 8.5 m, height 0.4 m. Mound No 5: Diameter 12.5 m, height 0.5 m. Mound No 6: Diameter 6 m, height 0.2 m.
3	Three burial mounds.	Early Iron Age	Mound No 1: N - 43°35'29.47" E- 76°25'39.99" Mound No 2: N - 43°35'30.17" E- 76°25'34.76" Mound No 3: N- 43°35'30.52" E- 76°25'33.30"	Kurgan No 1: Diameter 13 m, height 0.5 m. Kurgan No 2: Diameter 10 m, height 0.3 m. Kurgan No 3: Diameter 10 m, height 0.4 m.

Below highlights the location of the 3 (three) archaeological sites identified by Margulan Institute for Archaeology in 2014, including the 120-meter protection zone around the CH objects, and the 240-meter survey corridor. The figure also includes the Project's proposed Right of Way along the alignment.

FIGURE 7-15: LOCATION OF KEY CULTURAL HERITAGE RESOURCES



ERM Site Visit

During the site visit 28 October – 8 November 2024, ERM held key consultations with Poligram and Margulan Institute of Archaeology through key informant interview. A cultural heritage site visit was conducted by ERM with representatives of KTZ and Integra, to the location of the CH site No. 3 and CH site No. 2. As the coordinates for the CH sites were only received on 29 November 2024, the site visit only included CH site No. 3 and CH site No. 2. The area of CH site No. 2 was visited during the Reconnaissance visit and CH site No. 3 was visited in the latest site visit. No ERM site visit was conducted to CH site No. 1.

<table>
<tr><th colspan="2">Site Visit Photographs</th></tr>
<tr><th>CH No. 1</th><th>CH No. 2</th></tr>
<tr><td>
CH No. 1. Photo taken by Margulan Institute of Archaeology, 2014, facing North with the railway in the background.</td><td>
CH No. 2. Photo taken by ERM from Reconnaissance site visit, facing North-East, September - October 2024, facing backwards to the railway.</td></tr>
<tr><th colspan="2">CH No. 3</th></tr>
<tr><td></td><td></td></tr>
<tr><td>CH No. 3. Photo taken by ERM from Social site visit, October 2024. On the furthest identified mound, facing South-East looking at the Project railway approximately 300 meters from the centreline.</td><td>CH No. 3. Photo taken by ERM from Social site visit, October 2024. On the furthest identified mound, facing South-West looking at the Project railway approximately 300 meters from the centreline.</td></tr>
</table>

Site Visit Photographs	
	
CH No. 3 Photo of the ground. Area characterised by extensive meadow fields.	CH No. 3 Facing South-West and the alignment. Area characterised by extensive meadow fields.
	
CH No. 3 "Signpost" [311]. Facing North-West, and back facing the alignment.	CH No. 3 "Signpost". Facing South and facing the alignment (alignment in the background of the photo).

[311] At the time of writing, ERM was not able to obtain an explanation from this signpost from Margulan Institute of Archaeology. It should be noted that the signpost sits on top of a mound at CH No. 3 site.

Site Visit Photographs	
	
CH No. 3 200 meters away from the "Signpost". Facing North and away from the alignment.	CH No. 3 200 meters away from the "Signpost". Facing South and facing the alignment and on-going construction activities.

Protection zone for key critical cultural heritage assets

As discussed earlier, the methodology for determining the protection zone, based on Order of the Minister of Culture and Sports of the Republic of Kazakhstan dated 14 April 2020, No. 86, is 40 meters protection zone + 40 meters zone for regulating the development + 40 meters for the zone of the protected natural landscape, which totals 120 meters. As such, no CH sites have been identified within a 240-meter corridor spanning the Project alignment (120-meter protection zone of each side of the alignment from the centreline).

7.10.3 POTENTIAL IMPACTS

The key findings are that:

- There are no CH sites in the RoW.
- There are non-replicable CH sites within the AoI, including the 3 (three) identified cultural heritage sites by Margulan, which is likely part of a broader Iron Age archaeological (burial) landscape. This archaeological resource is considered to be non-replicable cultural heritage but will not be impacted by the Project activities as they are located 200 meters away from the rail centreline.
- There is a likelihood that other CH sites can be found within the AoI.
- CH No. 2's 120-meter protection zone intersects with the Project's RoW, in the last 40 meters for the zone of the protected natural landscape, however the impact is expected to be negligible. Although there were no erected fences surrounding the 120-meter protection zone of CH No. 2, there was no observed construction activities within the 120-meter protection zone of the CH site.

Based on these findings there is a high possibility of uncovering further cultural heritage resources, including human remains, during ground disturbing activities in areas outside of the 240-meter survey corridor.

7.10.4 ASSESSMENT CRITERIA

The ERM Impact Assessment standard defines the magnitude of impacts and sensitivity of cultural heritage receptors (sites) as presented in **Table 7-55**. For this Supplementary ESIA, the following ERM Impact Assessment and categories of sensitivities apply:

- Replicable Cultural Heritage – Low Sensitivity
- Non-Replicable Cultural Heritage – Medium to High Sensitivity
- Critical Cultural Heritage – High Sensitivity

TABLE 7-55: CULTURAL HERITAGE IMPACT ASSESSMENT CRITERIA

Definitions			**Cultural Heritage Site Sensitivity**		
			Low	**Medium**	**High**
			Site is not specifically protected under local, national, or international laws or treaties; Site can be moved to another location or replaced by a similar site, or is of a type that is common in surrounding region; site has limited or no cultural value to local, national, or international stakeholders; and/or site has limited scientific value or similar information can be obtained at numerous sites. (Replicable Cultural Heritage)	Site is specifically or generically protected by local or national laws but laws allow for mitigated impacts; Site can be moved or replaced, or data and artefacts recovered in consultation with stakeholders; Site has considerable cultural value for local and/or national stakeholders; and/or Site has substantial scientific value but similar information can be obtained at a limited number of other sites. (Non-replicable Cultural Heritage)	Site is protected by local, national, and international laws or treaties; Site cannot be moved or replaced without major loss of cultural value; Legal status specifically prohibits direct impacts or encroachment on site and/or protection zone; Site has substantial value to local, national, and international stakeholders; and/or Site has exceptional scientific value and similar site types are rare or non-existent. (Critical Cultural Heritage)
Magnitude of Impact	**Negligible**	No discernible change in the physical condition, setting, or accessibility of the site.	**Negligible**	**Negligible**	**Negligible**
	Small	Small part of the site is lost or damaged, resulting in a loss of scientific or cultural value; Setting undergoes temporary or permanent change that has limited effect on the site's perceived value to stakeholders; Stakeholder/public or scientific access to site is temporarily impeded; and/or Historic building suffers minor, reparable, structural damage.	**Negligible**	**Minor**	**Moderate**
	Medium	A significant portion of the site is lost or damaged, resulting in a loss	**Minor**	**Moderate**	**Major**

Definitions		**Cultural Heritage Site Sensitivity**		
		Low	**Medium**	**High**
		Site is not specifically protected under local, national, or international laws or treaties; Site can be moved to another location or replaced by a similar site, or is of a type that is common in surrounding region; site has limited or no cultural value to local, national, or international stakeholders; and/or site has limited scientific value or similar information can be obtained at numerous sites. (Replicable Cultural Heritage)	Site is specifically or generically protected by local or national laws but laws allow for mitigated impacts; Site can be moved or replaced, or data and artefacts recovered in consultation with stakeholders; Site has considerable cultural value for local and/or national stakeholders; and/or Site has substantial scientific value but similar information can be obtained at a limited number of other sites. (Non-replicable Cultural Heritage)	Site is protected by local, national, and international laws or treaties; Site cannot be moved or replaced without major loss of cultural value; Legal status specifically prohibits direct impacts or encroachment on site and/or protection zone; Site has substantial value to local, national, and international stakeholders; and/or Site has exceptional scientific value and similar site types are rare or non-existent. (Critical Cultural Heritage)
	of scientific or cultural value; Setting undergoes permanent change that permanently diminishes the site's perceived value to stakeholders; Site becomes inaccessible for the life of the Project to stakeholders including traditional users or researchers; and/or Historic building suffers major structural damage that is not reparable.			
High	The entire site is damaged or lost, resulting in a nearly complete or complete loss of scientific or cultural value; Setting is sufficiently impacted to cause site to lose nearly all or all cultural value or functionality; Site becomes permanently inaccessible to	**Moderate**	**Major**	**Major**

Definitions			**Cultural Heritage Site Sensitivity**		
			Low	**Medium**	**High**
			Site is not specifically protected under local, national, or international laws or treaties; Site can be moved to another location or replaced by a similar site, or is of a type that is common in surrounding region; site has limited or no cultural value to local, national, or international stakeholders; and/or site has limited scientific value or similar information can be obtained at numerous sites. (Replicable Cultural Heritage)	Site is specifically or generically protected by local or national laws but laws allow for mitigated impacts; Site can be moved or replaced, or data and artefacts recovered in consultation with stakeholders; Site has considerable cultural value for local and/or national stakeholders; and/or Site has substantial scientific value but similar information can be obtained at a limited number of other sites. (Non-replicable Cultural Heritage)	Site is protected by local, national, and international laws or treaties; Site cannot be moved or replaced without major loss of cultural value; Legal status specifically prohibits direct impacts or encroachment on site and/or protection zone; Site has substantial value to local, national, and international stakeholders; and/or Site has exceptional scientific value and similar site types are rare or non-existent. (Critical Cultural Heritage)
		stakeholders including traditional users or researchers; and/or Historic building suffers major structural failure			

The Cultural Heritage Assessment was undertaken in accordance with the provisions of the IFC PS8 in consideration of the following three categories (**Table 7-56**).

TABLE 7-56: IFC CULTURAL HERITAGE CATEGORIES

Category	Description
Tangible cultural heritage	Considered a unique and often non-renewable resource that possesses cultural, scientific, spiritual, or religious value and includes moveable or immovable objects, sites, structures, groups of structures, natural features, or landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural value.
Natural Heritage	Refers to unique natural features, landforms or tangible objects that embody cultural values, such as sacred groves, rocks, lakes, waterfalls, as part of non-urban cultural landscape considerations.
Intangible Heritage	Also referred to as Living Heritage. Refers to forms of culture that are proposed to be used for commercial purpose that include things like cultural knowledge, innovations, and practices of community the embody traditional lifestyles.

7.10.5 IMPACT ASSESSMENT

7.10.5.1 BASELINE FINDINGS

Baseline findings suggest that no cultural heritage resources were found within the 240m corridor protection zone. However, CH No. 2's 120m protection zone intersects with the Project's RoW, in the last 40m for the zone of the protected natural landscape. The identified cultural heritage resources are classified as tangible cultural heritage, and according to IFC PS8 definitions and categorised as 'non-replicable'[312] cultural heritage owing to a relatively extensive distribution of Iron Age mound (burial) sites are across Kazakhstan. However, these sites are also irreplaceable archaeological resources that cannot be removed without causing irreparable damage or destruction.

7.10.5.2 EMBEDDED CONTROLS

The original survey conducted by Margulan in 2014 identified three (3) CH sites of cultural significance, and was instrumental as an avoidance measure and informed the alignment so that direct impacts could be avoided.

However, based on consultations with KTZ during the site visit of 28 October – 08 November 2024, it was understood that the project has no embedded controls in place to protect cultural heritage, such as a Cultural Heritage Management Plan (CHMP) or a Chance Finds Procedure (CFP). The representative informed of the specific national law related to chance finds, referring to the law № 288-VI 3PK, dated 26 December 2019, and that if CH objects were found during construction work, the workers would report it to the relevant authorities, but there was no indication of how workers were trained to find such objects, or how this procedure was documented.

7.10.5.3 IMPACT SIGNIFICANCE

The anticipated impact during construction and operation is assessed as **Small** to **Negligible**, although there is a high possibility of uncovering further cultural heritage resources, including human remains, during ground disturbing activities in areas outside of the 240-meter survey corridor that have not been subject to assessment. As construction works have already begun,

312 Kurgan sites are 'tangible' cultural heritage as archaeological resources.

earthworks in the 14 quarries[313] (located outside the 240-meter protection corridor) have begun, and thus it is imperative to apply the following mitigation measures proposed below. The identified cultural heritage resources are classified as 'non-replicable' and assigned a **Medium** sensitivity.

Overall, the impact significance is considered **Minor** for the Project Area of Influence (AoI) but **Negligible** for the Project Right of Way (RoW).

7.10.5.4 MITIGATION MEASURES / RECOMMENDATIONS

A **Cultural Heritage Management Framework (CHMF)** has been prepared to supplement the Supplementary ESIA. The following recommendations are proposed in the CHMF.

- **Impact Avoidance and preparation of Kurgan Archaeological Landscape Mitigation and Management Guideline[314]**
  - The Project should limit impacts to the identified cultural heritage sites and sensitivity areas of the AoI.
  - No project activities should occur within the demarcated 'No Go' zones, i.e. the statutory protection zone of the identified CH sites located in the AoI, including lay down areas, access tracks, and placement of temporary structures.
- Ensuring good control of the works activities for management of potential impacts to cultural heritage sites by preparing a 'Kurgan Archaeological Landscape Mitigation and Management Guideline' to provide guidance on the above points.
- **Cultural Heritage Awareness Induction**
  - All personnel involved with construction activities within the Project Area should undertake a cultural awareness induction prior to commencing any activities. The cultural heritage awareness induction should include:
    - A summary of the cultural heritage values of the AoI;
    - Guidance on the identification of potential CH; and
    - An explanation of the Chance Finds Procedure.
- **Chance Finds Procedure[315]:** In the event that cultural heritage sites or materials (or suspected cultural sites or materials) are discovered during earthworks, development operations or similar activities, the procedure at is to be implemented.
- **Public Awareness:** Disclose information during public consultations about location of cultural heritage assets which should be protected.
- **Promotion of Cultural Heritage during Operation Phase:** A catalogue of archaeological assets discovered during the project and delivered to the museums should be prepared, promoted and published. If no other archaeological assets are discovered, the promotion of the existing cultural heritage site should still be conducted via the public media, and in the relevant Akimats made available to the public.
- **New works / activities being undertaken in previous undisturbed areas:** Depending on the extent of proposed works, further **Cultural Heritage Site Screening**[316] may be required if

[313] Information of the 14 quarries is shared in **Section 3.4** of the Project Requirements, and the geo-referenced location of the 14 quarries provided as an Appendix in the LRP.
[314] The Kurgan Archaeological Landscape Mitigation and Management Guideline has been prepared by ERM. Refer to the CHMF.
[315] A Chance Find Procedure has been prepared by ERM. Refer to the CHMF.
[316] A Cultural Heritage Site Screening has been prepared by ERM. Refer to the CHMF.

further earthwork activities are proposed in undisturbed areas previously not identified/subject to this assessment. If a risk is identified, a licensed CH authority, such as Margulan Institute or other, can advise the client on requirements. This recommendation should be integrated into the Project's Management Plans.

7.10.5.5 SUMMARY

The impact significance for uncovering cultural heritage resources due to the construction and operational activities is summarised is **Table 7-57**.

TABLE 7-57: IMPACT SIGNIFICANCE OF CONSTRUCTION AND OPERATIONAL ACTIVITIES ON UNCOVERING CULTURAL HERITAGE RESOURCES

Category	**Impact before Mitigation**	**Residual Impact**
Nature	Negative	
Type	Direct	
Duration	Short term to Long-term	
Extent	Local	
Scale	Limited to Project AoI	
Frequency	During construction and operational phase	
Significance (Highest Level)	**Minor**	**Negligible**

8. RAPID CUMULATIVE IMPACT ASSESSMENT

8.1 INTRODUCTION

This section presents a rapid cumulative impact assessment (RCIA) for chosen valued environmental and social components (VEC) in the Area of Influence (AoI) of the Almaty Railroad Bypass project following the IFC's *Good Practice Handbook— Cumulative Impact Assessment and Management: Guidance for Private Sector in Emerging Markets (the "Handbook") (2013).* IFC PS1 defines the project AoI to encompass "cumulative impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned, or reasonably defined developments at the time the risks and impact identification process is conducted." The RCIA follows the analytical framework proposed in the IFC Handbook (2013) based on a desk review of readily available information and the E&S assessments conducted as part of the Supplementary ESIA.

In the context of the Almaty Railroad Bypass as a strategic infrastructure project to support regional connectivity, the project will lead to localised economic development and land use change for the five (5) districts concurrently with future planned projects. The five (5) districts include Karasay, Zhambyl, Iliy, Talgar and Alatau City. Although the cumulative impacts due to the Almaty Railroad Bypass in concert with multiple projects should be typically identified in government-sponsored assessments and regional planning efforts, it is expected that KTZ will work with relevant Almaty regional authorities across the districts within the AoI to take forward the measures that have been proposed to avoid, reduce, or mitigate such cumulative impacts and risks on the chosen VECs to the extent possible[317].

8.1.1 KEY TERMINOLOGY

Table 8-1 provides the definitions for key terminology used in the RCIA.

TABLE 8-1: KEY TERMINOLOGY USED IN THE RCIA

Terms	Definition
Cumulative Impact	Impacts that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future actions, projects, or activities. For practical reasons, the identification, assessment, and management of cumulative impacts are limited to those effects generally recognised as important based on scientific concern and/or concerns of affected communities[318].
Other developments	Existing, planned, or reasonably expected future developments, projects and/or activities potentially affecting VECs.
External Drivers	Sources or conditions that could affect or cause physical, biological, or social stress on VECs, such as natural environmental and social drivers, human activities, and external stressors. These can include climate change, population influx, natural disasters, or deforestation, among others.

[317] IFC. (2013). Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets.
[318] Affected communities are defined as local communities directly affected by the project (IFC Performance Standard 1, paragraph 1).

Terms	Definition
Negligible impact Significance	Negligible impact refers to a situation where the contribution of a project to the overall cumulative impact is so small that it does not measurably affect the environmental or social conditions in the area of influence. In cumulative impact assessments, negligible impacts are often screened out from detailed analysis as they do not significantly alter the baseline environmental or social conditions. Therefore, for a chosen VEC, if the Almaty Railroad Bypass Project's impact assessment has been assessed to have negligible impact significance, the project has not been considered as contributing to cumulative impacts.
Valued Environmental and Social Component (VEC)	Environmental and social attributes considered to be important by the scientific community and/or project-affected communities. VECs may include: • Physical features, habitats, wildlife populations (e.g., biodiversity, water supply). • Ecosystem services (e.g., protection from natural hazards, provision of food). • Natural processes (e.g., water and nutrient cycles, microclimate). • Social conditions (e.g., community health, economic conditions). • Cultural heritage or cultural resources aspects (e.g., archaeological, historic, or traditional sites). VECs are considered the ultimate recipients of cumulative impacts because they tend to be at the ends of ecological pathways. VECs refers to sensitive or valued receptors of impact whose desired future condition determines the assessment end points to be used in the RCIA process.

8.1.2 OBJECTIVE AND SCOPE

The overall objective of this RCIA is to identify and assess the contribution by the Project to cumulative impacts in the Project AOI. It is a desk-based assessment based on information presented throughout prior sections of this Supplementary ESIA, and information available in the public domain. The specific objectives are to:

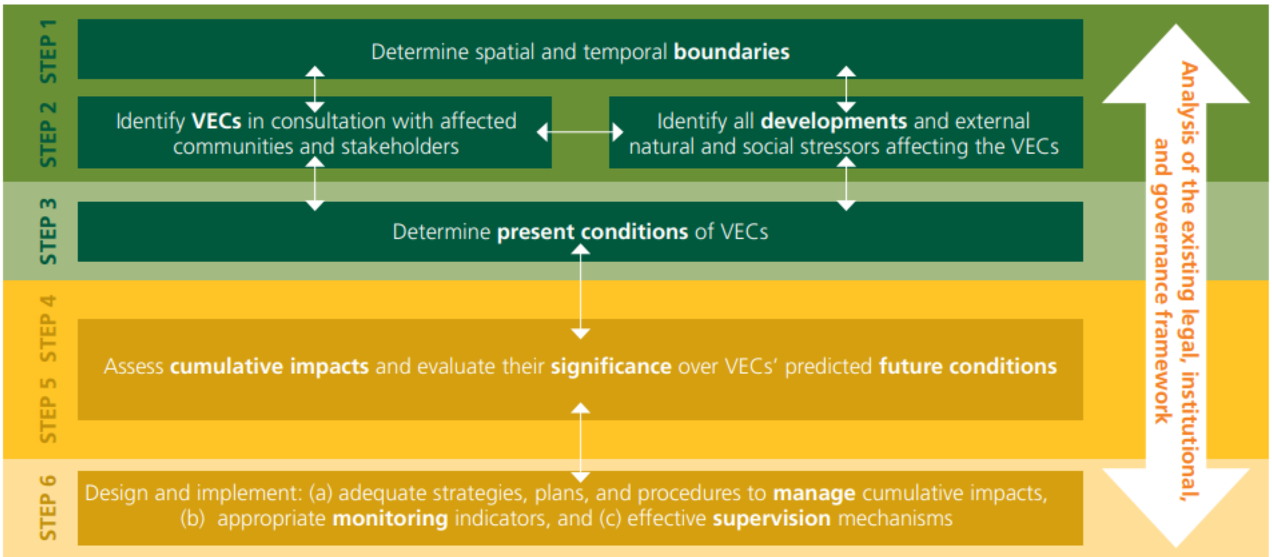
- Identify VECs that could be impacted cumulatively in the Project AoI.
- Identify other existing and planned developments and external environmental and social drivers that could cumulatively impact VECs.
- Determine VEC present baseline conditions.
- Undertake a high-level assessment of potential cumulative impacts and their significance over VECs' predicted future conditions, considering potential past, present and future effects from other developments and natural environmental and social external drivers on VECs.
- Recommend a management framework that adheres to the mitigation hierarchy[319] for the integrated management of potential cumulative impacts.

8.1.3 OVERVIEW OF METHODOLOGY

The section presents the overarching methodology of the RCIA in accordance with the 2013 IFC Handbook and aligned with the six-step process outlined in **Figure 8-1**.

[319] Defined in Performance Standard 1, paragraph 3, as the strategy to first anticipate and avoid impacts on
and risks to workers, the environment, and/or Affected Communities or, where avoidance is not possible, to minimize impacts and risks.

FIGURE 8-1: RCIA SIX-STEP APPROACH (IFC, 2013)



8.1.4 LIMITATIONS TO THIS RCIA

The National EIA (InTech, 2023) did not assess cumulative impacts since Kazakhstan's legislation does not explicitly mandate the need for conducting a CIA / RCIA. The RCIA is prepared as a part of the Supplementary ESIA. The limitations that apply to this RCIA include:

- Lack of any Almaty Region strategic environmental and social assessments available in the public domain;
- Incomplete and/or preliminary information about other projects and activities in the near term, including a definite implementation timeline;
- The quality of the information for the chosen VEC within the identified spatial boundary varies and can affect the accuracy of the RCIA; and
- Difficulty in establishing thresholds or limits of acceptable change for VECs, and therefore the significance of cumulative impacts has been qualitatively assessed.

8.2 STEP 1 – DETERMINE SPATIAL AND TEMPORAL BOUNDARIES

8.2.1 TEMPORAL BOUNDARIES

The temporal boundary for the RCIA considers available information on other proposed projects, the present project schedule and the current understanding of the strategy of the 'Almaty Region' towards longer-term development of the five districts, i.e. Karasay, Zhambyl, Iliy, Talgar and Alatau City. The temporal boundary of the RCIA is defined as the project lifecycle, i.e. from Q1 2023 to the end of 2055. This period encompasses the key milestones and phases of the Project, including the operational phase of the Project [320].

The RCIA will assess the cumulative impacts of the project's activities within this temporal boundary. It should be noted that while this assessment does not include post-closure and/or handover impacts (if relevant), assessment of developments at the end of the first three years

[320] The operational lifespan of the trainline is assumed to be 30 years.

of operations and ongoing monitoring and management may be required beyond 2055 to ensure any cumulative impacts are appropriately managed.

8.2.2 SPATIAL BOUNDARIES

Spatial boundaries are a composite of the project's AoI, the likely location of VECs to be identified and the overlap with other external projects and stressors. The spatial boundaries considered for this RCIA are the respective AoI[321] for air, noise, soil and groundwater, surface water, biodiversity and social defined in the Supplementary ESIA Main Report. The boundaries for different aspects typically extend (depending on the aspect) from areas directly underneath the Project footprint to 1 km as measured from the centre-alignment of the Bypass.

For the RCIA, ERM has adopted the administrative boundaries of the five (5) Project districts as defined in the Social AoI in the Supplementary ESIA Main Report to scope in projects that were relevant to the RCIA in **Step 2**. A more tailored focus was applied for the selected VEC baseline and assessments conducted in **Steps 3 to 6**.

8.3 STEP 2 - IDENTIFICATION OF VECS, OTHER DEVELOPMENTS AND EXTERNAL DRIVERS

8.3.1 IDENTIFICATION OF VECS

Preliminary VECs were identified from information obtained during the Supplementary ESIA process and information available in the public domain. The VECs could be cumulatively impacted by the Project, other developments (such as railway infrastructure, roads and transmission lines) and natural and anthropogenic external drivers. The key VECs and associated receptors that are likely to be impacted by the Project's activities for consideration in the RCIA include:

Physical environment:

- Ambient air quality and noise level: The nearby residential areas, schools, and hospitals could be affected by potential airshed pollution due to emissions from the Project and elevated noise level generated by the Project's activities.
- Surface water resources: The Uzyn Kargaly, Zhyngyldy, Zhamankyul, Kaskelen, Malaya Almatinka, and Karasu Baiserke rivers and Lake Balkhash Basin as well as irrigation canals could be affected by the wastewater released from the Project.
- Soil and groundwater resources: The agricultural lands and groundwater water supply surrounding the project could be affected by changes in soil and groundwater quality.

Aquatic ecosystems:

The aquatic VECs can be divided into three (3) components to enable distinction of cumulative impacts arising from within and outside the project AoI. The latter is from abetted industrialisation and urbanisation.

- River and stream crossings along the railway alignment and due to likely impacts from the construction, their basins within and outside the project AOI
- The Sorbulak Lake

[321] The Project AoIs are specified in the Supplementary ESIA main report **Sections 6** and **7.**

- Other wetlands within the Sorbulak Lake system

Terrestrial ecosystems: Given varying behaviour across birds and susceptibility to cumulative impacts such as collision and electrocution risks from power transmission infrastructure, this VEC has two (2) components.

- Soaring raptors
- Other soaring birds

Social:

- Grazing Land: The project could lead to increased pressure on grazing land and livestock access.
- Public Infrastructure and Services: The project requires new railways, stations, bridges, overhead power lines, substations, worker accommodations during the construction phase and the diversion of utilities, which could impact the surrounding area.
- Community health and safety: The nearby residential areas, schools, and medical centres could be affected by changes in air quality, noise, traffic, pedestrian safety or other impacts from the Project.

8.3.2 EXISTING AND PLANNED DEVELOPMENT

Other developments were identified using knowledge gained through the Supplementary ESIA process, stakeholder engagements and the interpretation of readily available external data. This includes activities associated with utility clearance along the alignment such as dismantling and diversion of transmission utilities, existing pipelines to be re-routed and existing optic fibre cables to be rerouted. The existing and planned projects were identified as relevant with respect to their potential impacts to interact with the Project impacts on VECs within the identified RCIA spatial and temporal boundaries and presented in **Table 8-2**. The approximate locations of the other projects are presented **in Figure 8-2**.

FIGURE 8-2: MAP OF EXISTING AND PLANNED PROJECTS

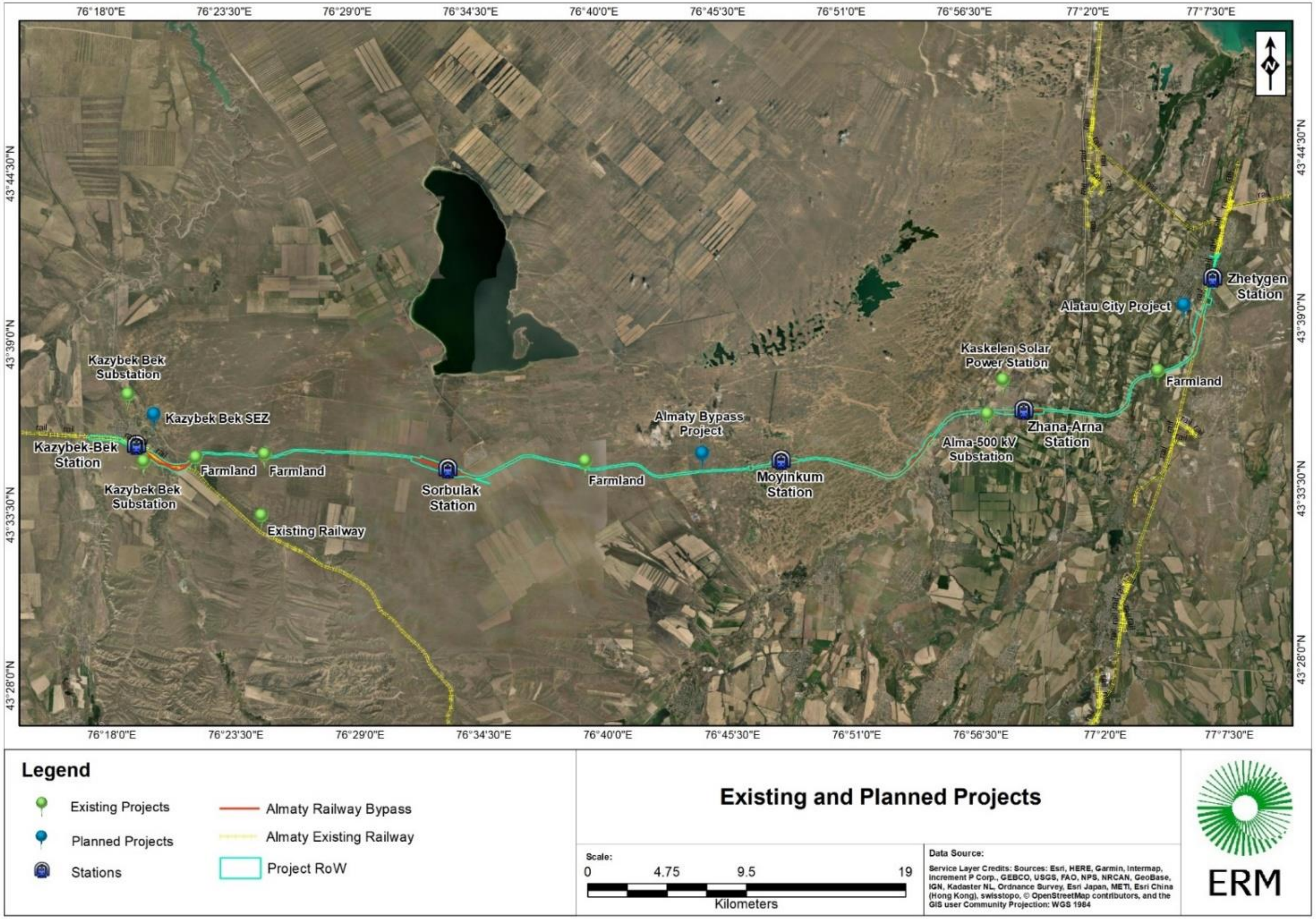


TABLE 8-2: OVERVIEW OF EXISTING AND PLANNED PROJECTS

No.	Project name	Location	Responsible Entities	Project overview
Existing projects				
1.	Altyn-Khorgos border crossing railway route and existing passenger and freight railway lines	The Almaty Bypass will be a part of this railway route.	KTZ Khorgos Gateway Chinese Railway Authorities	The route facilitates further transits towards four stations: Shu, Aktogay, Altynkol, and Almaty-2. Through these four (4) stations, the railway junction provides transport to the countries and regions described below: The Shu station is located west of the Project, in the Zhambyl region of Kazakhstan; the city borders Kyrgyzstan and neighbours Uzbekistan. Aktogay is located northeast of the Project, in the Abai region of Kazakhstan, and a major railway hub of the Turkestan-Siberian Railway which connects Central Asia with Siberia. East to the project, Altynkol is located in the Almaty region of Kazakhstan and is part of the Altynkol-Khorgos border crossing between Kazakhstan and China. South of the Project, the Almaty-2 station is close to the city centre of Almaty and facilitates passenger transport.
2.	Kaskelen Solar Power Station	1.05km north of Zhana Arna Station	Universal Energy Co., Ltd.	A 50MW solar power plant with annual electricity generation of 62.5mm kWh by Universal Energy Co. Ltd., a Chinese company began operations in 2020 and has been boosting local employment and increasing local renewable energy supply. The project connected to a 500kV substation with a new connection point[322].
3.	Kazybek Bek Substation	4.3km north of Kazybek Bek Station	KTZ	An electrical substation situated north of the village of Kazybek Bek. Further information on this substation is unavailable at the time of writing.
4.	Kazybek Bek Substation	60m north of Kazybek Bek Station	KTZ	Improvement works as part of the Almaty Bypass Project to be conducted to the existing substation.

[322] 5.Universal Energy Company. (2019). *Newsletter – November and December*. Retrieved from https6.://www.universalenergy.com/upload/default/20200325/da568420-6b1a-464b-af42-41d9f6dab662.pdf

No.	Project name	Location	Responsible Entities	Project overview
5.	Alma-500kV Substation	~1km southwest of Zhana Arna Station	KTZ	The 500kV substation will be connected to the new Project substation at Zhana Arna station. The Alma-500 Substation is a 500kV high-voltage electrical facility located in southeastern Kazakhstan, serving as a key node in the country's transmission network. Originally constructed under the World Bank–financed Alma Electricity Transmission Project (approved in 2008 and completed around 2014–2015), the substation is now fully operational and integrated into Kazakhstan's main grid[323]. Owned and operated by the Kazakhstan Electricity Grid Operating Company (KEGOC), Alma-500 was developed alongside upgrades to nearby substations (Almaty and YuKGRES) and the construction of new overhead transmission lines.
6.	Kazakhstan-China Gas Pipeline (Asian Gas Pipeline)	The pipeline stretches from the Aktobe region to various locations in China, including the Xinjiang Uyghur Autonomous Region	Intergas Central Asia Gas Pipeline LLP (AGP) PipeChina Turkmengaz Uztransgaz	The Asian Gas Pipeline stretches 3,916km and intersects the project at two points: PK312+91.2 and PK508+33[324]. It connects Kazakhstan to China, supplying gas for both domestic use and exports to the Chinese market. The project aims to facilitate the transit of Turkmen and Uzbek gas, export Kazakh gas to China, and ensure a reliable gas supply to southern Kazakhstan.
7.	Intergas Central Asia	The pipeline network distributes gas to several regions in	Intergas Central Asia	The 15,260 km pipeline network operated by Intergas Central Asia transports natural gas within Kazakhstan and to neighboring countries

[323] World Bank, 2023. 'Alma Transmision Project', available at: https://projects.worldbank.org/en/projects-operations/project-detail/P116919, accessed 27 January 2025.
[324] Based on information provided by Poligram on 17 January 2025.

No.	Project name	Location	Responsible Entities	Project overview
		southern Kazakhstan and to China.		through Russia, Uzbekistan and Turkmenistan.[325] Operational since the early 2000s, the system ensures a reliable natural gas supply throughout the region. The Project intersects two key branches of this network[326]: The Almaty–Taldykorgan pipeline at PK22+91.40 The Almaty–Baiserke–Talgar pipeline at PK577+58.60
8.	Diversion of overhead transmission lines	Various	Kazakhstan Electricity Grid Operating Company (KEGOC) Alatau Zharyk Company JSC (AZHK) Mistral Energy LLP	A total of 18 overhead transmission lines intersecting the Project's RoW will be diverted in consideration of the Project. This will be undertaken by the responsible parties including the Kazakhstan Electricity Grid Operating Company (KEGOC), a state-owned entity overseeing the country's electrical utilities, the Alatau Zharyk Company (AZHK).
Planned projects				
9.	Alatau City project	Adjacent to Zhetygen Station	Almaty Region Akimat Caspian Group	The Alatau City project is strategically positioned along the "New Silk Road," aiming to become a global financial, export-oriented, and tourist centre[327]. The city is set to implement comprehensive digitization and automation across all necessary processes, positioning it as a smart city and attracting technology-driven industries[328]. Plans include the development of infrastructure to support industries such as finance, education, healthcare, and tourism.[329] The city will be developed to

[325] KazMunayGas, 2021. 'Gas Transportation and Marketing', available at: https://ar2021.kmg.kz/en/strategic-report/operating-review/gas-transportation-and-marketing#:~:text=Intergas%20Central%20Asia%20(ICA)%20is%20the%20national,with%20a%20total%20length%20of%2012%2C532%20km, accessed 27 January 2025.
[326] Based on information provided by Poligram on 17 January 2025.
[327] Caspian Group. (2024). *Alatau City*. Retrieved 5 December 2024, from https://caspian.kz/en/project_groups/2
[328] KAZAKH INVEST. (2024). *SEZ and IZ*. Retrieved 5 December 2024, from https://almaty.invest.gov.kz/doing-business-here/special-economic-zone/
[329] Temirgaliyeva, A. (2024). *Kazakhstan's new city Alatau – What changes are expected*. Retrieved 2 December 2024, from https://en.inform.kz/news/kazakhstans-new-city-alatau-what-changes-are-expected-205378/

No.	Project name	Location	Responsible Entities	Project overview
				establish more residential areas, commercial districts and public spaces designed for a population of 2 million residents[330]. The city of Alatau was established this year, in January 2024 and was formerly the village of Zhetygen in the Iliy district of the Almaty region.[331] The government has expanded the local Special Economic Zone (SEZ) from 30,000 hectares to 96,500 hectares and renamed it the Alatau SEZ. This expansion aims to facilitate over 170 production projects across various economic sectors, potentially creating approximately 110,000 new jobs.[332] According to estimates, the SEZ will provide more than 1.1 million jobs by 2050[333]. The TULIP industrial zone is expected to serve as a foundation for forming the new city, with the creation of many jobs leading to a concentration of people in the new territory.[334]
10.	Kazybek Bek SEZ	Adjacent to Kazybek Bek Station	Ministry of Investment and Development of Kazakhstan Local Akimat	According to ERM's KII with the Kazybek Bek Akim on 5 November 2024, there will be a planned SEZ to be constructed once construction for the Project is completed. There is an existing smaller scale Kazybek Bek Industrial Zone that has been in operation for ~2 years. With the investment brought about by the Project, the new Kazybek Bek SEZ will build upon the existing Industrial Zone and provide local employment opportunities.

330 Surbana Jurong. (n.d.). *Alatau City*. Retrieved from https://surbanajurong.com/sector/alatau-city/#:~:text=Located%20in%20the%20northward%20extension,and%201.1%20million%20new%20jobs.
331 Sakenova, S. (2024). *Kazakhstan welcomes new town—Alatau*. Retrieved 2 December 2024, from https://astanatimes.com/2024/01/kazakhstan-welcomes-new-town-alatau/
332 The Times of Central Asia. (2024). *New city, Alatau, established in Kazakhstan*. Retrieved 2 December 2024, from https://timesca.com/new-city-alatau-established-in-kazakhstan/
333 Alatau SEC. (n.d.). *What is SEZ Alatau?*. Retrieved from https://alatausez.kz/sez
334 KAZAKH INVEST. (2024). *KAZAKH INVEST discusses progress of the Alatau City project*. Retrieved 5 December 2024, from https://invest.gov.kz/media-center/press-releases/kazakh-invest-discusses-progress-of-the-alatau-city-project/

No.	Project name	Location	Responsible Entities	Project overview
				The SEZ will have a residential zone which would provide housing for over 6,000 workers. The land acquired for the new SEZ was mostly agriculture and pastureland. There is about 113,000 ha of agriculture land and the pastureland area was unspecified during the KII. The area will also be connected to a water source and a sewage system.
11.	Almaty Bypass Project future development	Along the Bypass	Ministry of Industry and Infrastructural Development of Kazakhstan Local Akimat	Planned railway facilities expansion and built environment around the stations.
12.	Launch of a modernized pig farm in Almaty Oblast	Daulet village, Talgar district, Almaty oblast	EcoMeat LLP.	The project includes the construction of a slaughterhouse with capacity of 800 heads per shift and the launch of pig-breeding complex for 46,800 heads, creating a total of 113 jobs. It is planned to produce 3,338 tons of products. It is expected to export pork meat to China (83%) and to domestic market (17%)[335].

[335] KAZAKH INVEST. (2024). *Launch of a modern pig farm in Almaty Oblast*. Retrieved 3 February 2025, from https://invest.gov.kz/doing-business-here/invest-projects/8241/

Determining the extent of the various impacts of these projects allows for a decision to be made as to whether there is the potential for an overlap in project impacts that could lead to a measurable cumulative impact. Key to this includes but are not limited to the following:

Temporal and Spatial Interaction: Where potentially interacting developments are not located close enough, sufficiently linked through various ecological and social processes or project components do not overlap in time, cumulative impacts are less likely.

Consideration or Impact Type: While there may not be direct geographical overlap in project boundaries, there is the possibility that their offsite impacts may directly overlap elsewhere and cause offsite cumulative impacts. Examples are air pollutant emissions.

8.3.3 EXTERNAL DRIVERS

Climate change in the Almaty region and gradual urbanisation around the stations are the anticipated external drivers for the RCIA. As per **Section 6.9** of the Supplementary ESIA Main Report, future projection of climatic variables predicts changes in weather patterns, including potential increases in maximum temperatures and decreases in minimum temperatures. These changes could exacerbate the impacts of the Project and other developments in the area, particularly in relation to biodiversity. For example, changes in maximum and minimum temperatures could affect ecosystems, potentially impacting species that are already under stress from habitat loss and other impacts.

The development of stations along the alignment (along with proposed plans for special economic zones as identified in **Section 8.3.2**) would bring about urbanisation effects to rural areas and semi-urban areas along the alignment. These changes could enhance economic prospects for surrounding rural regions by improving access to markets, services, and infrastructure. However, without effective planning, urbanization may lead to adverse social and environmental consequences. For instance, rural communities may experience economic displacement as land is repurposed and/or potentially gentrified for urban development, necessitating robust resettlement plans that ensure compensation and restoration of livelihoods. Moreover, urbanisation can strain local resources, resulting in challenges such as pollution and increased living costs.

Other environmental and social drivers have been assumed to be captured as part of the project baseline and the impact assessment. Specific additional identification and assessment of these drivers is deemed to not be required for the RCIA.

8.3.4 SCREENING OF RELEVANT VECS TO SCOPE INTO THE RCIA

The VEC screening process to determine which of the preliminary VECs would be relevant for scoping into the RCIA for the Almaty Railroad Bypass Project is presented in **Figure 8-3**.

The VECs were selected to focus primarily on the operations phase of the other development projects. Pre-construction/construction related impacts such as due to increase in transport activity, if not mitigated, may result in cumulative impacts on VECs. The findings from the screening process are presented in **Table 8-3**.

Note: While assessing importance to stakeholders, ERM has considered consultations undertaken as part of the Supplmentary ESIA, particularly for the biodiversity and social studies, with Akimats and local communities along the alignment.

FIGURE 8-3: VEC SCREENING PROCESS

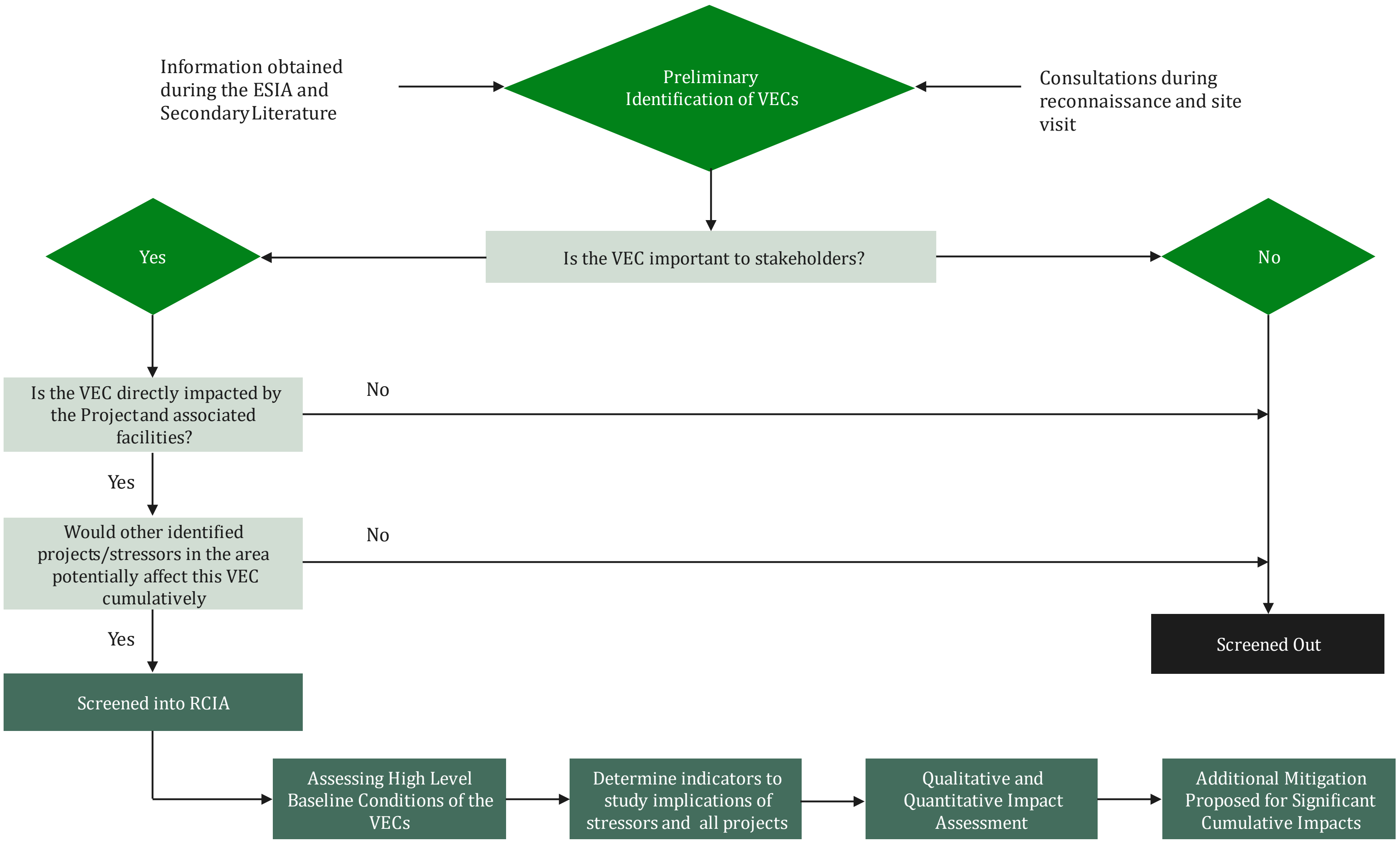


TABLE 8-3: VECS SCREENING AND SELECTION

No.	Potential VEC	Importance to Stakeholders	Impacted by Project	Impacted by other developments and external drivers	Screened into the RCIA	Justification and comments
Physical Environment						
1.	Air Quality	No specific reference made	Yes, but limited to project AoI and not the overall spatial boundary	Yes	No	As stated in the Main Report, dust and traffic emissions from the construction and operation phases of the Project were assessed as having Negligible to Minor significance. Potential sources of air emissions from existing and planned projects are anticipated to be from increased economic/industrial activity brought about by the Alatau City and the Middle Corridor Project, urbanisation surrounding the Project stations and existing passenger train lines that run on diesel fuel. However, this VEC was scoped out as the existing and planned projects are not expected to contribute significantly enough to the overall emissions within the identified spatial boundary to result in a cumulative impact on air quality.
2.	Noise	Yes	Yes, impacts can extend beyond the project AoI in the operations phase	Yes	Yes – for the operation phase	As stated in the Main Report, the Project's noise impact significance during construction was deemed Negligible to Minor. The Project's noise impact significance during operation was assessed as Minor to Moderate. Based on ERM's Focus Group Discussions (FGDs) and Community Consultations, the nuisance impacts during construction and operation and the need for measures such as noise barriers were raised as suggestions/concerns. Furthermore, most of the projects are currently in operation phase and noise generation from the projects is expected (e.g. noise from existing railway lines and industrial activities). For the planned projects, these are likely to be service and/or manufacturing oriented activities within the special economic zones.

No.	Potential VEC	Importance to Stakeholders	Impacted by Project	Impacted by other developments and external drivers	Screened into the RCIA	Justification and comments
						Noise as a VEC was scoped into the RCIA because the Project could contribute to cumulative increases in noise levels during operations phase and could affect nearby communities and other ecological receptors.
3.	Soil and groundwater resources	No specific reference made	Yes, but limited to project AoI and not the overall spatial boundary	No	No	As stated in the Main Report, the Project's soil and groundwater impact significance during construction and operations was assessed as Minor. Most of the projects are currently in operation phase and soil and groundwater pollution is possible (e.g. agriculture chemicals and fertiliser usage, diesel oil storage and usage from diesel powered passenger trains along existing railway lines, increased industrial activity and associated hazardous material storage and usage). However, it is expected limited groundwater usage and that agriculture and industrial hazardous waste management will meet local regulations and is not expected to generate negative impacts. This VEC was scoped out of the RCIA.
4.	Water resources	Yes	Yes, but limited to project AoI and not the overall spatial boundary	No	No	As stated in the Main Report, the Project's surface water quality impact significance during construction and operation was assessed as Minor. Most of the projects listed in **Section 8.3.2** are currently in operation phase and water quality pollution is possible (e.g. agriculture wastewater runoff, diesel oil runoff from diesel powered passenger trains along existing railway lines and industrial runoff). However, it is expected that agriculture and industrial wastewater runoff and discharge management will meet local regulations and is not expected to generate negative impacts. It is noted that attendees of the EIA Public Consultation in Talgar District on 10 April 2024 were concerned about the Project wastewater

No.	Potential VEC	Importance to Stakeholders	Impacted by Project	Impacted by other developments and external drivers	Screened into the RCIA	Justification and comments
						management. The Supplementary ESIA has suggested appropriate mitigation measures as part of the Project ESMP and Construction ESMS. This VEC was scoped out of the RCIA.
Biodiversity						
5.	Migratory, Congregatory and threatened waterbirds associated with Sorbulak Lake System	No specific reference made	Yes	Yes	Yes- only cumulative impacts related to Sorbulak Lake have been scoped in	**River and stream crossings** • Temporary Sedimentation and Water Quality Degradation: Short-term increases in turbidity and sedimentation from bridge and culvert construction may temporarily impact aquatic habitat conditions in local rivers. However, as described above it is anticipated that the impacts of the project on water quality will be minor and within regulatory limits • The aquatic habitat within the project AoI and the larger landscape does not support significant abundance of priority biodiversity values. Discussions with SMEs and secondary data sources, including iBAT, iNaturalist, and field observations, identified five (5) vulnerable species; Seven (7) River's Minnow (*Phoxinus brachyurus*), Balkhash Marinka (*Schizothorax argentatus*), Ili Marinka (*Schizothorax pseudaksaiensis*), Severtsov's Loach (*Nemacheilus sewerzowi*), and Plain Thicklip Loach (*Triplophysa labiata*). **Sorbulak Lake and Associated Wetlands** • Wastewater Discharge and Nutrient Loading in the Sorbulak Lake System: The Sorbulak lake, is a wastewater reservoir for Almaty and already overburdened due to rising wastewater volumes. Additional discharge could potentially worsen eutrophication, leading to algal blooms, oxygen depletion, and long-term habitat degradation, affecting key bird populations. However as

No.	Potential VEC	Importance to Stakeholders	Impacted by Project	Impacted by other developments and external drivers	Screened into the RCIA	Justification and comments
						mentioned in the supplementary ESIA, there are several site-specific measures recommended that will mitigate overloading of the Sorbulak Lake system. • Increased Hunting Pressure in the Associated Wetland: The growing human footprint, including workforce settlements and associated infrastructure, may lead to increased hunting pressure on waterfowl populations particularly in the associated wetlands of the Sorbulak Lake. Given the vegetation cover around, easier hunting is possible. This could potentially affect species of conservation concern. • Urban and Industrial Expansion - Runoff, Groundwater Use, and Pollution Risks: Industrial and urban expansion in the region could lead to increased surface runoff carrying pollutants (e.g., oils, heavy metals, construction residues), potentially affecting river baseflows and aquatic habitat conditions, particularly during dry seasons. However, compliance with stormwater and wastewater management regulations is expected to mitigate major negative impacts. • Thermal Pollution and Industrial Discharges: • If industrial operations or power generation in the SEZ discharge heated water, temperature-sensitive aquatic species could be affected due to reduced dissolved oxygen levels and altered species composition. Similarly, accidental spills from increased transportation and handling of fuels and chemicals pose contamination risks, though proper environmental controls and best practices should minimise these threats. • Limited Cumulative Impact on the Lake Balkhash Basin • The planned SEZ and industrial developments are not expected to modify hydrological regimes or significantly affect water bodies as planned developments are not located near major surface water

No.	Potential VEC	Importance to Stakeholders	Impacted by Project	Impacted by other developments and external drivers	Screened into the RCIA	Justification and comments
						bodies. While localised and temporary effects on aquatic habitats may occur, no significant long-term cumulative impacts on the broader basin are anticipated. **Conclusion** The cumulative impacts on aquatic ecology from the railway project and associated developments are expected to be limited and manageable. The railway infrastructure is not expected to alter hydrological flows or cause long-term aquatic habitat degradation. However, the Sorbulak Lake System presents a key cumulative concern due to its existing overburdened state, and potential for further eutrophication. Increased industrial pollution, runoff, and accidental spills represent additional risks but are expected to be controlled through regulatory measures and proper environmental management. However, there are concerns of increased hunting pressure on threatened species within the associated wetlands of the Sorbulak Lake system. The Sorbulak Lake system is situated approximately 5 km from the proposed railway alignment. Due to the absence of legal protection for the lake system, illegal hunting has been a significant pressure on threatened and migratory congregatory birds. The construction and operation of the railway, along with other planned projects, are likely to exacerbate hunting pressures by increasing anthropogenic movement in the area. All three (3) Aquatic ecology VEC components were thereby scoped out of the RCIA with the exception of increased hunting pressure on threatened bird species within the associated wetlands of the Sorbulak Lake system.
6.	Terrestrial Ecology	Yes	Yes	Yes	Yes- only cumulative	The terrestrial ecology within the project area will experience cumulative impacts due to multiple infrastructure developments:

No.	Potential VEC	Importance to Stakeholders	Impacted by Project	Impacted by other developments and external drivers	Screened into the RCIA	Justification and comments
					impacts on threatened raptors have been scoped in	• Habitat Loss and Modification: Construction activities, including excavation, embankment creation, and vegetation clearing, will lead to direct habitat loss and alterations. With multiple ongoing and planned projects habitat fragmentation and minor disruptions to species movement and resource access may occur though none of the species using relevant habitat or of conservation significance. • Introduction and Spread of Invasive Alien Species (IAS): Construction-related disturbances and material transport may introduce and propagate invasive species, potentially displacing native flora and fauna and causing long-term ecosystem degradation though none of the ecosystems in the spatial boundaries are unique or threatened and the spatial boundary including the semi-desert habitat has experienced significant alien species proliferation. • Wildlife Mortality from Infrastructure Development: The combined footprint of multiple projects will increase wildlife mortality risks. Train movement poses a collision risk to terrestrial fauna, particularly mammals and avian species, while small species like rodents and reptiles may become trapped in railway infrastructure. Expanding road networks and energy infrastructure may further exacerbate habitat fragmentation and vehicle-wildlife collisions, intensifying overall mortality risks for local biodiversity. However, design interventions may mitigate some collision impacts. Additionally, the absence of wildlife corridors, congregatory sites, or high-density populations of species of conservation importance reduces overall species sensitivity. • Cumulative Semi-Desert Habitat Loss: The expansion of multiple projects will contribute to semi-desert habitat loss in the larger

No.	Potential VEC	Importance to Stakeholders	Impacted by Project	Impacted by other developments and external drivers	Screened into the RCIA	Justification and comments
						region, impacting the Vulnerable Central Asian Tortoise. Increased human presence and habitat modification may disrupt its long-term population viability in the region, however given its wide-ranging distribution impacts on global population are not envisaged. Furthermore, semi-desert habitat quality and extent is not comparable to that found in central Kazakhstan. • Predator Attraction, Electrocution, and Collision Risks: ○ Soaring Raptors The presence of a pig farm as well as other forms of waste disposal from increased urbanization such as landfills etc may attract predators and scavengers, elevating densities significantly above baseline values. This, combined with the expansion of transmission lines for the railway, solar power plant, and other projects, will heighten the risk of electrocution and collision for large raptors. A total of 27 raptor species have been recorded in the area, including species of conservation concern such as four Endangered species—Egyptian Vulture (*Neophron percnopterus*), Pallas's Fish-eagle (*Haliaeetus leucoryphus*), Steppe Eagle (*Aquila nipalensis*) and Saker Falcon *(Falco cherrug*)— two Vulnerable species—Eastern Imperial Eagle (*Aquila heliaca*) and Greater Spotted Eagle (*Clanga clanga*) —and three Near threatened species —Cinereous Vulture (*Aegypius monachus*), Himalayan Griffon (*Gyps himalayensis*) and Pallid Harrier (*Circus macrourus*). Twelve of these species are listed in the Red Data Book of the Republic of Kazakhstan. Due to localized aggregations this could have significant impacts on population viability especially for threatened species such as Egyptian Vultures.

No.	Potential VEC	Importance to Stakeholders	Impacted by Project	Impacted by other developments and external drivers	Screened into the RCIA	Justification and comments
						Cumulative infrastructure expansion will impact threatened raptors through collisions with infrastructure, electrocution and collision risks from transmission lines. This VEC except for soaring raptors was scoped out for the RCIA. **Other soaring birds** There will be other soaring birds flying over the RCIA spatial boundary. These would largely include cranes, storks, swans, ducks, geese etc. that fly to and from the Sorbulak Lake system during breeding and the migration season. However, there are no established stopovers within the spatial boundary of the RCIA overlapping areas with a high density of transmission lines. Therefore, it is highly unlikely that soaring birds will fly at heights prone to collision with transmission infrastructure or lines or will perch on transmission towers enhancing electrocution risks. This VEC for other soaring birds is scoped out of the RCIA.
Social						
7.	Community Health and Safety	No specific reference made	No	Yes	No	As stated in the Main Report, the Project's community health and safety impact significance was assessed as Minor. The Project is expected to have limited, localised impacts to the communities in the immediate vicinity of the Project. Respondents surveyed by ERM shared safety concerns in relation to the use of shared level crossings for vehicles and pedestrians around stations, which are expected to be mitigated by the implementation of road safety measures. In comparison, existing and planned projects may have community health and safety impacts from construction, blasting works and increased air and noise pollution across the five districts of the RCIA AoI.

No.	Potential VEC	Importance to Stakeholders	Impacted by Project	Impacted by other developments and external drivers	Screened into the RCIA	Justification and comments
						Concerns include health risks such as Tuberculosis, Hepatitis C, HIV, viral infections[336] from the workforce migrating to the project areas. With potential population growth and urbanisation at Alatau City and built-up areas of the Project, community health and safety may have significant cumulative impacts. As localised impacts of the Project are not likely to extend into the broader spatial boundary of the RCIA, this VEC was scoped out.
8.	Grazing land	Yes	Yes	Yes	Yes	As stated in the Main Report, the Project's impact significance of loss of communal grazing lands and disruption of household or community activities was assessed as Minor. Potential cumulative impacts from loss of communal grazing lands is not expected, however the livestock may have trouble grazing barrier free and in safe access routes. Based on ERM's FGDs, KIIs and Community Consultations, the protection of livestock from Project construction activities was raised as a grievance. ERM's surveys indicate that the government has determined that people need to grow their livestock holdings as there is far greater capacity than what is currently utilised. Based on ERM's KII with the Kazybek Bek Akim on 5 November 2024, farmers want to make full use of their land and increase cattle population. It is noted that the Project will build cattle crossings to ensure livestock grazing access is maintained. However, several projects may disrupt the livestock grazing access routes, unless the respective project proponents and the Akimat have consulted with the affected communities and worked out barrier-free alternative access routes (across types of movement and seasons). Furthermore, as per trends, all the servicing, warehousing and logistics functions are moving far outside

[336] American International Health Alliance. (n.d.). *Kazakhstan*. Retrieved from https://www.aiha.com/ourstory/our-footprint/kazakhstan/

No.	Potential VEC	Importance to Stakeholders	Impacted by Project	Impacted by other developments and external drivers	Screened into the RCIA	Justification and comments
						existing urban areas with the key requirement of low cost and reliable all-weather connectivity. Future planned developments as such could have cumulative impacts on this VEC. This VEC was scoped in for the RCIA.
9.	Public Infrastructure and Services	No specific reference made	No	Yes	No	As stated in the Main Report, the Project's impact significance on public infrastructure and services was assessed as Negligible. While there may be potential impacts due to the construction of labour camps during construction phase and the in-migration of workers from other regions of Kazakhstan, the impacts are likely to be temporary. At the time of writing, according to KTZ, all construction labour camps have been dismantled. Other impacts on infrastructure include the construction of stations, substations and the shifting of existing transmission lines which intersect the Project. While the rail infrastructure is expected to increase connectivity in the region, the Project will only be operating freight trains. Hence there would be minimal adverse impacts to the public infrastructure and services at a local level. Interruptions to utilities or public services are expected to be temporary in nature. In addition, the development of larger residential areas and other facilities to service planned projects such as SEZs are likely to lead to an overall increase in the availability and access to public infrastructure and services. This VEC was scoped out for the RCIA.

8.4 STEP 3 – VEC BASELINE

In summary, the four VECs that have been screened into the RCIA are: i) Ambient Noise (**Section 8.5.1**), ii) increased hunting pressure on threatened bird species within the associated wetlands of the Sorbulak Lake system (**Section 8.5.2**), iii) Soaring raptors (**Section 8.5.4**) and iv) Grazing Land (**Section 8.5.4**).

The present conditions of the identified VECs are described in the respective early-stage sections of the Main Report. The current understanding of these conditions as well as their potential resilience has been used to identify and assess the potential cumulative impacts presented in sections below.

The current spatial boundary of the VECs is based on the social impacts SAoI encompassing the five (5) districts mentioned in **Section 8.2.2**. However, for physical environmental impacts, such as ambient noise, the spatial boundary considered for assessment is smaller than the overall RCIA AoI. This is because noise impacts diminish with distance, and beyond a certain range (300 meters from source for industry standards), the cumulative effects become negligible. The baseline data for these physical VECs, such as noise, has been adjusted to reflect the relevant areas where impacts are most pronounced, ensuring that the assessment remains focused on areas where significant effects are likely. Therefore, while the RCIA AoI accounts for broader social impacts, the baseline for noise and other physical environmental impacts is scoped to areas where the effects are most significant and relevant.

8.5 STEP 4 AND 5 – ASSESS CUMULATIVE IMPACTS ON VECS AND DETERMINE THE EFFECT SIGNIFICANCE

Impact identification should be aligned to those assessed throughout the main body of the Supplementary ESIA and needs to include impacts recognised as important based on genuine scientific concerns and the views of stakeholders. This allows for impacts to be appropriately grouped and added to impacts identified as likely to occur from other projects.

Thus VECs, for which there is a proposed project residual impact that is deemed to be **Negligible** in the Supplementary ESIA, would not be included in the RCIA in accordance with IFC CIA guidance note. Where the residual impacts are defined as **Minor**, **Medium** or **High**, these would be scoped into the RCIA depending on the potential impact magnitude cumulatively.

A largely qualitative approach will be taken for the RCIA to enable a focus upon identification of trends across the various projects in the area, their temporal and spatial interactions and how these are likely to impact upon VECs. Whilst impacts from the project have been defined and assessed in isolation, it can be difficult to accurately quantify cumulative impacts due to the high degree of uncertainty in interactions with other projects and activities occurring in the area as well as a lack of confirmed project information. Therefore, the impacts are to be assessed qualitatively based on the identified trends and grouped according to the impact type, rather than the VEC, in accordance with the overall methodology adopted for the Supplementary ESIA. The RCIA is also based on the assumption that all assessed residual impact levels within the Supplementary ESIA are achievable.

8.5.1 CUMULATIVE IMPACTS ON AMBIENT NOISE LEVELS

Based on the operation noise assessment in **Section 6.3**, the Project's residual noise impact significance during operations was assessed as **Minor** to **Moderate**. When considered in the context of cumulative impacts, the potential noise levels in the region could be exacerbated due to concurrent developments and ongoing industrial and infrastructural activities.

The key contributors to ambient noise include:

- **Existing Infrastructure and Transportation Networks** - Existing noise sources from surrounding existing railway lines or infrastructures that are already in operation.
- **Planned and Ongoing Projects** - Operation of other planned projects or expansion of existing infrastructure.
- **Increased Traffic and Heavy Machinery Movement** - Transportation network expansion from the increased movement of vehicles, trains and heavy machinery associated with planned developments. During the operational phase of the planned projects, it is expected that there will be ongoing noise emissions from roads and rail.

One major contributor to cumulative noise impacts is the Alatau City project, it includes the development of infrastructure to support industries such as finance, education, healthcare, and tourism and will be developed to establish more residential areas. As the project progresses, it is expected to attract a growing population, necessitating new transportation infrastructure to accommodate increased mobility demands. This can contribute to additional noise to the existing noise sensitive receptors.

Therefore, regarding cumulative noise impacts, concurrent developments in proximity to sensitive receptors (residential buildings, schools, etc.) could potentially increase the significance of the noise impact.

The noise impact magnitude from the Project's contribution alone was assessed as Minor to Moderate but is likely to escalate due to overlapping activities from other developments. Consequently, the cumulative impact significance could potentially increase to **High**, driven by the Alatau City project.

8.5.2 CUMULATIVE IMPACTS ON THREATENED BIRD SPECIES WITHIN THE ASSOCIATED WETLANDS OF THE SORBULAK LAKE SYSTEM

Of all the impacts assessed (ref. **Table 8-3**), most are expected to be localized, temporary, and manageable through appropriate mitigation measures. For instance, temporary sedimentation from construction activities is anticipated to be controlled through standard erosion and sediment control plans, and potential industrial pollution risks are expected to be mitigated through compliance with regulatory frameworks governing wastewater discharge and stormwater management.

However, the Sorbulak Lake System remains a primary concern due to the increased hunting pressures on migratory and congregatory bird populations within the associated wetlands. Sorbulak Lake supports a high concentration of waterbirds, including globally significant species such as the White-headed Duck (*Oxyura leucocephala*, EN), Dalmatian Pelican (*Pelecanus crispus*, VU), Ferruginous Duck (*Aythya nyroca*, NT) etc. This risk arises from the growing human footprint, including workforce settlements and infrastructure, which is likely to facilitate easier access for hunting in the area. However, the implementation of recommended mitigation measures, such as access control, enforcement of hunting regulations, awareness trainings and signages, and regular refresher trainings, can reduce these risks. The aquatic ecology impact magnitude from the Project's contribution alone was assessed as **Negligible to Minor** but is likely to escalate due to overlapping activities from other developments. Consequently, the cumulative impact significance could potentially increase to **Minor to Moderate** based on above assessment and the presence of threatened species.

8.5.3 CUMULATIVE IMPACTS ON SOARING RAPTORS

Of all the impacts assessed (ref. **Table 8-3**), most are expected to be localised, temporary, and manageable through appropriate mitigation measures. For example, habitat loss and modification due to construction activities, including excavation and vegetation clearing, will likely result in disruptions to species movement and resource access, but these are not expected to significantly affect species of conservation concern. Similarly, the introduction and spread of invasive alien species (IAS) due to construction-related disturbances are anticipated to have limited long-term impacts, given the widespread presence of alien species in the region and the lack of unique or highly threatened ecosystems within the project's spatial boundaries. Wildlife mortality risks from infrastructure, including collisions with vehicles or trains, are expected to be mitigated by design interventions, such as wildlife-friendly fencing and wildlife corridors.

However, the presence of threatened raptors and the potential risks associated with collisions and electrocution are the primary concern for cumulative impacts. The expansion of infrastructure will increase food availability in the area, particularly through upcoming developments such as a pig farm and increased waste disposal from the planned cities. The presence of these anthropogenic food sources will likely attract scavengers, including various raptor species. These species, which include globally threatened species such as the Egyptian Vulture (*Neophron percnopterus*), Pallas's Fish-eagle (*Haliaeetus leucoryphus*), Steppe Eagle (*Aquila nipalensis*), and Saker Falcon (*Falco cherrug*), are already using the landscape, with 27 raptor species recorded, including four (4) Endangered species, two Vulnerable species, and three (3) Near Threatened species. As food availability increases, these species may congregate in higher-than-usual densities, which, in combination with the ongoing expansion of transmission lines for the railway and solar power plant, may pose significant risks of electrocution and collision.

Furthermore, collision risks with infrastructure further exacerbate these threats. Train strikes, particularly for gregarious avian species, can result in multiple fatalities during a single event. Infrastructure elements like power lines, poles, and embankments attract birds by providing nesting, perching, or hunting opportunities, especially for raptors[337], increasing mortality risks from collisions and electrocution.

The impact significance of the Project on threatened raptors was assessed as **Minor** in **Section 6.4**. However, the potential cumulative impact significance is assessed to be at least **Moderate** with the above assessment.

[337] Van Rooyen, C. S., & Ledger, J. A. (1999). Birds and utility structures: Developments in Southern Africa. In M. Ferrer & G. F. E. Janns (Eds.), *Birds and power lines: Collision, electrocution, and breeding* (pp. 205–229). Quercus.

8.5.4 CUMULATIVE IMPACTS ON GRAZING LAND

The loss of communal grazing lands—often administered by the District Akimat -- reduces the land area and corridors through which herders and community members can freely and safely move. Cumulative impacts arising from the loss of communal grazing lands include the availability and accessibility of barrier-free and safe access routes for livestock grazing.

Livestock Grazing Patterns in Kazakhstan

In post-Soviet Kazakhstan, the dissolution of large state farms and loss of collective infrastructure have forced herders to adapt to more localised and varied grazing patterns. Capital-intensive requirements for seasonal movement (such as vehicles and wells) have proved especially challenging for small-scale livestock owners, leading many to remain near settlements where resources and services are more readily accessible. Nonetheless, the ecologically diverse rangelands across the five (5) districts still support some degree of mobility—particularly for larger herd owners who can afford hired shepherds, specialized equipment, and remote site infrastructure. Four distinct grazing management systems that have emerged under these circumstances[338]:

- Sedentary village flocks: Typically, small individual holdings, the livestock remain close to or in the villages/settlements throughout the year. Animals are grazed in the vicinity of the villages/settlements. In winter, animals may be stall-fed in barns depending on weather conditions and the availability of nearby pastures.
- Mobile livestock entrusted with larger flocks: These livestock owners (usually with very small flocks) place their livestock with larger flocks which are taken to different and distant pastures, usually through relatives or other villagers. Some of these owners also group their flocks with other small flocks and hire shepherds to manage their animals.
- Sedentary flocks distant from villages: Owners usually have larger holdings and settle outside of villages on lands with water sources and farm structures (such as barns, wells, shepherd houses, among others). The owners usually stay with the livestock year-round or hire workers which take care of the animals.
- Large mobile flocks: Animals are moved to different pastures throughout the year depending on seasonality and availability of pastures. Most flocks have hired shepherds or family members to help care for the animals.

Impact Rating

The impact significance of the Project on access to grazing land was assessed as minor in the social impact assessment (**Section 7**) due to the availability of alternative grazing lands in the region. However, the potential cumulative impact significance of the loss of grazing lands is assessed to be at least **Moderate**.

This is in consideration of the concurrent and future planned projects for land use around the stations (such as the development of the Kazybek Bek SEZ and the development of Alatau City), which may disrupt livestock grazing access routes, especially as such areas become increasingly urban.

[338] Kerven, C., Alimaev, I. I., Behnke, R., Davidson, G., Malmakov, N., Smailov, A., & Wright, I. (2006). *Fragmenting pastoral mobility: Changing grazing patterns in post-Soviet Kazakhstan*. USDA Forest Service Proceedings RMRS-P-39. Retrieved 4 January 2025, from https://www.fs.usda.gov/rm/pubs/rmrs_p039/rmrs_p039_099_110.pdf

As these traditionally open spaces used for grazing and pastureland are converted to other uses or fragmented (for example, by the mentioned urban development projects or SEZs), routes that were once barrier-free become obstructed or less direct, forcing people and livestock to navigate roads, fences, and private properties. Urbanisation compounds this effect by expanding transportation networks, commercial buildings, and residential areas into former grazing zones, creating hazards (e.g. traffic) and physical barriers (e.g., fences, walls) that impede safe transit for herders and for livestock[339].

Without coordination, proactive planning and a consultative process with stakeholders, these developments could create cumulative barriers across movement types (e.g., herds, vehicles) and limit the usability of communal grazing lands, if not for a lack of communal grazing lands in the vicinity of grazers, then due to safety concerns and/or a lack of awareness of the locations of available crossings.

8.6 STEP 6 – MANAGEMENT OF CUMULATIVE IMPACTS

Effective application of the mitigation hierarchy (avoid, reduce, mitigate, and compensate) to manage individual planned developments and stressors contribution of cumulative impacts is recommended as best practice. The Project and other planned development in the impacted area should incorporate project design features that include physical and procedural controls to avoid and reduce possible impacts that are planned as part of the projects. The responsibility for the management of cumulative impacts ought to be collective, requiring individual actions to eliminate or minimise each individual development's contributions.

Alongside the mitigation and monitoring measures described in Supplementary ESIA impact assessment chapters for individual topics possible further possible recommendations for mitigation and management measures to avoid/minimise/restore potential cumulative impacts on the selected VECs are described here. It is recommended that KTZ organise a workshop along with key regional and district level authorities to discuss potential cumulative impacts on ambient noise, increased hunting pressures on the Sorbulak Lake ecosystem, terrestrial ecology and grazing land in order to take forward the mitigation measures into specific actions and/or general community-based and conservation focused projects. KTZ's ESMU can help monitor some of these actions for the initial years to ensure that the project's obligations towards cumulative impacts for the chosen VECs are managed to the extent feasible.

[339] While this impact relates to community severance in that urban expansion and infrastructure developments restrict access to traditional grazing routes, the primary concern is the impact on livestock movement and the usability of communal grazing lands. However, without mitigation, these disruptions could also have broader implications for rural livelihoods and mobility.

TABLE 8-4: FURTHER POSSIBLE MONITORING, MITIGATION AND MANAGEMENT MEASURES

VEC	Possible Monitoring, Mitigation and Management Measures	Responsible Agencies
Ambient Noise	Facilitate communication and coordination between projects within the impact area to address cumulative noise impacts. Sharing information on schedules, activities, and mitigation measures can help align efforts, reduce overlapping impacts, and optimise noise reduction strategies. Encourage the adoption of quieter machinery, vehicles, and equipment in construction and operations. This includes transitioning to electric or hybrid vehicles, using noise-dampening materials, and employing best practices to minimise noise emissions.	KTZ in collaboration with other relevant governing bodies.
Migratory, Congregatory and threatened waterbirds associated with Sorbulak Lake System	KTZ will support a local governing body (e.g. regional committee for forestry and wildlife) in the review of existing regulations permitting hunting of aquatic birds, an assessment of challenges in the implementation and the development of an enhanced strategy to control hunting of aquatic birds with emphasis on the Sorbulak Lake system.	KTZ in collaboration with other relevant governing bodies.
Terrestrial Ecology	<u>Collaboration with Stakeholders on Waste Management</u> Joint Waste Management Plans: Engage with local authorities and other developers, such as those involved in the upcoming pig farm and planned urban developments, to establish coordinated waste management plans. These plans will ensure that organic waste and food sources do not accumulate near transmission lines or other infrastructure, which could attract raptors and increase the risk of electrocution or collision. Strategic Waste Disposal Locations: Work with authorities to identify and designate waste disposal sites located far from transmission line or other infrastructure. This effort can reduce the likelihood of attracting scavenging species and mitigate the cumulative impacts of waste management. <u>Insulation and Perch Management for Transmission Lines</u> While the project proponent cannot directly enforce mitigation measures on other developments, they can play a vital role in coordinating with nearby projects and stakeholders. Organise meetings with other	KTZ in collaboration with other relevant governing bodies.

VEC	Possible Monitoring, Mitigation and Management Measures	Responsible Agencies
	developers, local forest and wildlife authorities, and conservation groups to ensure a unified approach to managing cumulative risks and sharing best practices for raptor conservation which may include: Risk Mapping: Possibility to collaborate with relevant authorities should be explored to develop a cumulative risk map that identifies areas of high risk for bird collisions and electrocution based on infrastructure projects across the region. This map can inform decision-making on where mitigation measures should be prioritised and assign responsibility to relevant stakeholders. Ongoing Monitoring: Conduct long-term monitoring of raptor populations in collaboration with wildlife department and other project proponents to assess the effectiveness of mitigation measures. Data should be shared with local authorities, conservation groups, and other stakeholders.	
Grazing Land	Coordinate with other projects and local authorities to minimise disruptions and align mitigation measures across multiple developments. Engage with affected communities to identify and develop barrier-free alternative grazing routes that reasonably accommodate all types of movement and seasonal patterns. Coordination at a regional and district level to plan for safe access to and availability of communal grazing lands to meet local needs. Ensure that cattle crossings and other mitigation measures are integrated into all relevant projects and designed to maintain safe, efficient access for livestock and herders.	Regional, District and Village Akimats and any other relevant authorities (with the support of KTZ)
	Engage with the local district Akimats to ensure that established grazing routes are disclosed to all impacted parties on a seasonal basis, particularly to the settlements along the alignment and around the stations. Establish a monitoring framework to evaluate the effectiveness of cattle crossings and access routes relevant to the Project over time, adapting measures as needed.	KTZ, EPC (to coordinate with Akimats)

VEC	Possible Monitoring, Mitigation and Management Measures	Responsible Agencies
	Implementation of the livelihood restoration program (e.g. livestock enhancement)—KTZ to obtain the support of the Akimats.	

9. ENVIRONMENTAL & SOCIAL MANAGEMENT PLAN

9.1 INTRODUCTION

An Environmental and Social Management Plan (ESMP) has been prepared for the Almaty Rail Bypass Project's development as part of the Supplementary ESIA. At the time of writing (Q1 2025), the Project was under construction, as land preparation and construction works had commenced in November 2023. This ESMP is intended to address impacts identified to the extent feasible as part of the remaining construction phase and the operations phase.

The purpose of this ESMP is to provide a consolidated summary of all the Environmental and Social (E&S) commitments relevant to the Project that have emerged as an outcome of the Supplementary ESIA. The ESMP documents the proposed set of E&S commitments, i.e. mitigation measures, management and monitoring programs and specific actions to be taken for the ongoing and forthcoming stages of the Project development to minimise adverse environmental and social impacts, compensate them, offset them, or reduce them to acceptable levels in accordance with the Applicable Reference Framework outlined in **Section 3**.

The ESMP can be updated as the Project progresses through late construction, commissioning and operation to reflect prospective changes in the alignment; the results of discussions with stakeholders; and to include details of any other E&S developments in the area of influence, to the extent that they interact with the Almaty Rail Bypass (for instance any utilities such as overhead transmission lines that will need to be diverted).

While the EPC contractor Integra and the proposed operations phase contractor will be responsible for ESMP implementation, KTZ shall be accountable for putting in place an overarching structure (i.e. the proposed E&S Management Unit) to collaborate, drive execution, resource, monitor and document the progress.

9.2 SCOPE AND OBJECTIVES OF THE ESMP

The ESMP is a guiding document for KTZ, Integra and any other contractors for the remainder of the construction phase and for the operation phase and is intended to ensure that the Project Activities at the Project Sites and Facilities are controlled and operated in line with the Project Standards.

The main objectives addressed within this ESMP are the following:

- Define general high level environmental and social requirements for the construction stage.
- Determine relationship between the management plans and other documents within the Project's ESMS.
- Identify the required resources to ensure implementation of activities provided for by the management plans.
- Outline the auditing, monitoring, and reporting procedures to assess implementation of Framework ESMP and other management plans.

In general, the scope of the risks and impacts managed by the ESMP shall include the Project activities stated in **Section 2** Project Description and will be within the spatial boundaries of the Project Area of Influence (AoI), as defined in **Section 6 and 7**.

The requirements of the ESMP are applicable to all Project personnel, including personnel of Contractors and Subcontractors (*Project Personnel*), as well as to non-Project personnel and other individuals visiting Project Sites and Facilities (*Visitors*).

9.3 PROJECT STANDARDS

The Project will be governed by the Republic of Kazakhstan laws, regulations, and subject to Lender's requirements, standards, guidelines and other documents (applicable reference frameworks, detailed in **Section 3**).

Since the Project Standards are numerous and diverse, the Project may encounter a situation where several documents prescribe different requirements to same aspects. In such cases, the Project will apply the most stringent of the standards in question.

Commitment to conform to the Project Standards for the remainder of the construction phase will need to be reflected in the contracts between KTZ and Integra, potentially through an addendum and prospectively in the contracts between KTZ and the Operation and Maintenance (O&M) Contractor.

For utilities (such as optic fibre cables, overhead transmission lines, gas pipelines or water pipelines) that are to be diverted and/or cleared by other Kazakhstan government entities, but which are to be funded by KTZ, it is assumed that KTZ will use leverage to extend the Project Standards and relevant requirements under the ESMP, to the extent applicable, for use by the contractors undertaking such activities.

9.4 IDENTIFICATION AND ASSESSMENT OF E&S RISKS AND IMPACTS

9.4.1 SUMMARY OF E&S RISKS AND IMPACTS

The Supplementary ESIA has described the Project activities, receptors and sensitivities in the AoI and assessed whether these interactions (between project activities and receptors/sensitivities) could lead to a significant impact considering the data and information provided by KTZ. As described in the Impact Assessment Method in **Section 5**, impacts that are assessed to be **Major** or **Moderate** are considered significant and warrant further consideration as to whether the impact has been reduced to ALARP and/or whether additional mitigation to reduce the impact is practical and feasible. **Minor** or **Negligible** impacts typically do not require further consideration for as low as reasonably practicable (ALARP) or mitigation. In some cases, for impacts assessed as **Minor**, additional mitigation measures which are considered best practice have been recommended.

A summary of the Supplementary ESIA impact significance ratings is presented in

TABLE 9-1: SUMMARY OF ESIA SIGNIFICANCE RATINGS

Receptor	Impact	Impact Significance within Minimum Controls	Residual Impact Significance with Mitigation Measures (if required)
Pre-construction/Planning Phase			

Receptor	Impact	Impact Significance within Minimum Controls	Residual Impact Significance with Mitigation Measures (if required)
Social	Physical displacement of landowners and users	Moderate	Minor
	Economic displacement of landowners	Moderate	Minor
	Economic displacement of land users	Moderate	Minor
	Economic displacement impacts on commercial entities	Moderate	Minor
	Workers facing loss of employment due to land acquisition	Moderate	Minor
	Loss of communal grazing lands and disruption of household or community activities	Moderate	Minor
Construction Phase			
Air Quality	Construction Dust at stations	Moderate at Kazybek Bek station Minor at other stations	Minor at Kazybek Bek station N/A at other stations
	Construction Dust at alignment	Negligible	N/A
	Construction traffic exhaust at stations	Negligible to Minor	N/A
	Construction traffic exhaust at alignment	Negligible	N/A
Noise	Within 50m from Stations	Moderate to Major	Negligible to Minor
	Rest of the segment	Negligible	

Receptor		Impact	Impact Significance within Minimum Controls	Residual Impact Significance with Mitigation Measures (if required)
Vibration		Construction Vibration (beyond 30m)	Negligible	N/A
Surface Water		Construction Activities on Surface Water Quality	Minor	N/A
		Construction Activities on Hydrology	Minor	N/A
Soil and Groundwater		Soil cover and vegetation fertility	Minor	N/A
		Soil and groundwater quality	Minor	N/A
		Groundwater quantity	Minor	N/A
Biodiversity	Habitat loss and fragmentation	Habitat	Moderate	Minor
		Species	Minor to Moderate	Minor
	Introduction and Proliferation of Alien Species	Habitat	Minor	Negligible
		Species	Minor	Negligible
	Aquatic Ecology	Habitat	Moderate	Minor
		Species	Minor	Negligible
Social		Economic and employment opportunities	Positive	N/A
		Labour and working conditions	Minor	N/A
		Community health and safety	Moderate	Minor to Moderate
Operational Phase				
Air Quality		Operation traffic exhaust at stations	Negligible at Kazybek Bek station	Negligible at Kazybek Bek station

Receptor	Impact	Impact Significance within Minimum Controls	Residual Impact Significance with Mitigation Measures (if required)
		Negligible to Minor	N/A
	Operation traffic exhaust at alignment	Negligible	N/A
Noise	Train operation (at 60km/hr)	Major within 40m from railway centreline	Minor
		Moderate between 40m to 140m from railway centreline	
		Negligible beyond 140m from railway centreline	
	Train operation (at 40km/hr)	Major within 30m from railway centreline	Minor
		Moderate between 30m to 80m from railway centreline	
		Negligible beyond 80m from railway centreline	
	Train operation (at 20km/hr)	Major within 10m from railway centreline	Minor
		Moderate between 10m to 40m from railway centreline	

Receptor		Impact	Impact Significance within Minimum Controls	Residual Impact Significance with Mitigation Measures (if required)
			Negligible beyond 40m from railway centreline	
		Railway station	Negligible	N/A
Vibration		Railway operation	Negligible	N/A
Surface Water		Railway Operation on Surface Water Quality	Minor	N/A
		Railway Operation on Hydrology	Minor	N/A
Soil and Groundwater		Soil and groundwater quality	Minor	N/A
		Soil erosion and potential seismic risk	Minor	N/A
Biodiversity	Wildlife mortality risks	Habitat	Moderate	Minor
		Species	Moderate	Minor
	Habitat fragmentation, degradation and wildlife barriers	Habitat	Minor	Negligible
		Species	Moderate	Minor
	Collison and Electrocution Risks from Transmission Line	Habitat	Moderate	Minor
		Species	Moderate	Minor
Social		Economic and employment opportunities	Positive	N/A
		Labour and working conditions	Moderate	Minor
		Community health and safety	Moderate	Minor
Throughout Pre-Construction, Construction and Operation				

Receptor	Impact	Impact Significance within Minimum Controls	Residual Impact Significance with Mitigation Measures (if required)
Social	Gendered impacts on women, including risks of gender-based violence	Moderate	Minor
Cultural Heritage	Possibility of uncovering further cultural heritage resources, and kurgan burial grounds, including human remains, during ground disturbing activities in areas outside of the 240-meter survey corridor.	Minor	Negligible
Cumulative Impacts on chosen VECs			
Cumulative impacts on chosen VECs	Ambience noise levels	High	
	Aquatic ecology	Moderate	
	Terrestrial ecology	Moderate	
	Grazing land	Moderate	

9.4.2 MANAGEMENT PROGRAMS

This section consolidates and documents the following:

- **Embedded Controls – Existing Committed Measures**: **Table 9-2** summarises key E&S controls the Project is required to adhere to in line with legislative requirements, and measures the Project has already committed to during the design process, from the National EIA and additional measures identified and that have been implemented based on the information provided by KTZ, Poligram and Integra.
- **Supplementary ESIA Mitigation Measures: Table 9-3** and **Table 9-4** consolidate mitigation measures that have emerged along with corresponding actions will be developed to ensure the Project complies with the applicable reference framework. These will include specific actions to mitigate identified risks. The Project will also adopt adaptive management approaches to address unforeseen impacts, ensuring that mitigation efforts are effective and timely.

- **Thematic Management and Monitoring Plans: Table 9-5** captures key management plans that support the Supplementary ESIA mitigation measures to address the specific aspects of environmental and social performance. It includes the suggested monitoring plans across key E&S indicators, including air quality, soil & water quality, noise, biodiversity, community health and safety, and social impacts, to ensure compliance with both the IFC and national regulations.

9.4.2.1 EMBEDDED CONTROLS

The embedded controls in **Table 9-2** below are from the National EIA and information provided by KTZ, Poligram and Integra. These embedded controls are included in the initial Project design and considered as committed actions that the Project has agreed to implement. All proposed controls are, at a minimum, compliant with national regulations and laws.

TABLE 9-2: SUMMARY OF EMBEDDED CONTROLS

No.	Aspect	Phase	Impact / Activity	Embedded controls description	Relevant Guidelines / Source of GIIP	Related Management Plan
1.	Air quality	Construction	Dust from construction activities	• Mandatory compliance of equipment, construction processes and operations with national laws and regulations. • Construction activities, movement of machinery and equipment, storage and handling of materials in areas not designated by the project are prohibited. • Dust suppression by watering of open construction sites during earthworks and bulk construction materials. • Construction machinery and vehicles to strictly follow designated temporary access routes and adhere to speed limits on access roads without hard surfacing. • Ensure soil, waste and sludge are covered during transport by vehicles. • Elimination of open storage, loading, and transportation of bulk loose materials. Instead, containers or specialised transport shall be used. • All preparatory and installation work will be carried out within a limited project area where appropriate. • Site cleanup and landscaping to restore vegetation cover after construction is completed. • All construction quarries will be backfilled with vegetation planted and areas with disturbed soil and vegetation will be restored to limit exposed soil surfaces and dust pollution after the completion of construction. Perennial grass will be sowed on the surface of fertile soil with mineral fertiliser added.	• WBG Environmental, Health, and Safety (EHS) Guidelines • WBG EHS Guidelines: Construction and Decommissioning • WBG Environmental, Health, and Safety Guidelines for Railways WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulphur Dioxide. • Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction • ISO 14001:2015 - Environmental management systems • USEPA's 40 CFR Part 1039 (Nonroad Engine Regulations) and 40 CFR Part 86 (Heavy Duty Vehicle Regulations)	• Pollution Prevention Plan – Air Emissions Management • Occupational Health and Safety Plan (OHSP)
2.	Air quality	Construction	Traffic exhaust	• Mandatory compliance of fuels, materials, products, equipment, construction processes and operations with national laws and regulations.		

No.	Aspect	Phase	Impact / Activity	Embedded controls description	Relevant Guidelines / Source of GIIP	Related Management Plan
				• During periods of adverse meteorological conditions[340], KTZ is required to implement temporary measures to reduce pollutants emitted into the atmosphere. Upon receiving a notification from Kazhydromet, the following measures will be implemented: ○ First mode: Measures should reduce the ground-level pollutant concentrations by approximately 15 – 20%. • Enhancing control over technological processes[341]. • Limiting high-emission activities[342]. ▪ Performing wet cleaning of places where workers are located within safety regulations. ○ Second mode: Measures should reduce the ground-level pollutant concentrations by approximately 20 – 40%. ▪ Implement all first mode measures. ▪ Restricting vehicle movement on site. ▪ Slightly reduce the efficiency and operation of units and technological lines associated with the release of comparatively greater concentrations of harmful pollutants. ▪ If scheduled repair work coincides with this mode, the equipment repair should be stopped. ○ Third mode: Measures should reduce the ground-level pollutant concentrations by approximately 40 – 60% ▪ Implement all first and second mode measures. ▪ Reduce the load or completely stop processes associated with the release of comparatively greater concentrations of harmful pollutants. • Construction machinery and vehicles to strictly follow designated temporary access routes and adhere to speed limits on access roads without hard surfacing. • Prohibit unnecessary idling of vehicle engines and construction machinery within parking areas and work sites.		
3.	Air quality	Operation	Traffic exhaust	• Prohibit unnecessary idling of vehicle engines within parking areas.		• Occupational Health and Safety Plan (OHSP) • Traffic Management Plan (TMP)

340 According to the legislation of Kazakhstan, adverse meteorological conditions (AMC) are special combinations of meteorological factors and synoptic situations that contribute to the accumulation of harmful (polluting) substances in the surface layer of atmospheric air. Such conditions include calm, light wind, fog and inversion, which prevent the dispersion of pollutants and lead to their accumulation in the atmosphere. The National Hydrometeorological Service of Kazakhstan informs the population about AMC.

341 For example, inspections of the progress of construction work will be strengthened to prevent any unplanned emissions of air pollutants.

342 These activities were not identified from the National EIA. From ERM's Almaty January 2025 Site Clarifications Excel, KTZ and Integra stated that construction activities identified were from heavy vehicles and equipment. However, further details and details on operation activities were unavailable.

No.	Aspect	Phase	Impact / Activity	Embedded controls description	Relevant Guidelines / Source of GIIP	Related Management Plan
4.	Noise and vibration	Construction	Construction Noise	• Siting noisy activities and plant as far as possible from sensitive receptors. • Limiting noisy activities to specific hours (e.g., daytime) to reduce disturbances to nearby residents and communities. • Selecting quieter plant and vehicles, e.g., electric-powered equipment instead of combustion engines, where possible. • Switching off plant and vehicle engines when not in use. • Establishing a buffer zone between construction activities and sensitive receptors. • Mandatory compliance of construction equipment, mechanisms, vehicles, processes, and operations with national laws and regulations. • Effective communication with the occupants of the nearby sensitive receptors that could be at risk of being exposed to higher (although temporary) noise emissions during significant stages of work. • Ensuring that site personnel are aware of the embedded measures listed. • During road construction, areas with sound levels exceeding 80dBA must be clearly marked with safety signs. Additionally, individuals working in these zones must be provided with appropriate personal protective equipment. • Production areas with engineering equipment with a high noise level are fenced off by partitions. • Configuring the construction traffic control system to minimise the need for mobile plant to reverse. Where reversing cannot be avoided, use alternatives to tonal reversing alarms, such as visual and/or broadband noise-emitting models. • Lowering items in a controlled manner rather than dropping them from heights. • Regularly maintaining equipment, plant, and enclosures. • Speed limit for site vehicles/trucks within the construction area.	• WBG Environmental, Health, and Safety (EHS) Guidelines • WBG EHS Guidelines: Construction and Decommissioning • WBG Environmental, Health, and Safety Guidelines for Railways WHO Guidelines for Community Noise • USFTA Transit Noise and Vibration Impact Assessment Guideline • ISO 14001:2015 - Environmental management systems •	• Pollution Prevention Plan – Noise and Vibration Management • Occupational Health and Safety Plan (OHSP)
5.	Noise and vibration	Construction	Construction Vibrations	• Vibration isolation through the use of vibration-damping supports, elastic gaskets, structural breaks, resonators, casings, and other methods. • Use of vibration-damping foundations for compressor machines. • Adoption of non-vibrating technological processes and units, along with the most efficient equipment placement schemes at production sites. • Reduction of vibration during machine or equipment operation by enhancing the rigidity and vibration-damping properties of structures and materials and stabilising the strength and other properties of components. • Installation of equipment that excites vibration is carried out only on massive foundations that are not connected with the building structures. • Using ground stabilisation methods to improve soil conditions and reduce the potential for vibration transmission through the ground.		
6.	Noise and vibration	Operation	Operation Noise from freight trains	• Train Speed Adjustment: Train speeds are controlled to reduce noise near sensitive areas like homes. The average speed is 60 km/hr, slowing to 40 km/hr within 1.5km of stations and further to 20 km/hr when approaching stations. This helps minimise noise while maintaining efficiency. • Train Track Design: A 30cm layer of gravel and sand ballast is used on station tracks to reduce noise and vibration. The ballast absorbs vibrations, preventing them from spreading through the ground and into buildings. • Regular Maintenance: Annual rail track inspections and maintenance ensure smooth surfaces and proper wheel alignment, helping to reduce noise and vibrations and keeping operations efficient.		
7.	Noise and vibration	Operation	Operation Noise from train stations	• Noise Barrier at Kazybek Bek Station: A 90m-long, 4.2m-high noise barrier called "Tuten" will be installed along Kazybek Bek Street to reduce noise for nearby homes and facilities. Positioned between residential buildings, a wheel plant, and a sewage pumping station.		

No.	Aspect	Phase	Impact / Activity	Embedded controls description	Relevant Guidelines / Source of GIIP	Related Management Plan
				• Ventilation Noise from Train Station: Ventilation systems will have noise mufflers such as tubular, plate, cylindrical, and chamber air ducts lined with sound-absorbing materials. Noise-reducing duct turns and GOST-standard machinery to protect workers from excessive noise.		
8.	Surface water quality	Construction	Construction activities on surface water quality	• Mandatory compliance of activities within protected shoreline belts and water protection zones with national laws and regulations. • Measures to prevent soil erosion, gully formation, as well as protective anti-erosion and anti-landslide measures must be implemented. Implementing erosion control measures, such as silt fences and sediment basins, to prevent sediment from entering nearby water bodies. During ERM's site visit from 28 October – 8 November 2024, it was observed that there was no erosion control measures at riverbanks except for stones placed on riverbanks at the Malaya Almatinka River bridge construction site. • All construction quarries will be backfilled with vegetation planted and areas with disturbed soil and vegetation will be restored to limit exposed soil surfaces and surface runoff after the completion of construction. Perennial grass will be sowed on the surface of fertile soil with mineral fertiliser added. • Elimination of open storage, loading, and transportation of bulk dusty materials. Instead, containers or specialised transport shall be used. • Preserving existing vegetation along rivers to filter runoff and reduce sedimentation. • Employing best practices for handling and storing hazardous materials to prevent spills and leaks that could contaminate surface water. • Disposing fuel-lubricating materials only at specially designated locations designated for this purpose. • Collection of domestic wastewaters into tanks for removal in sewerage trucks to offsite wastewater treatment facilities. • Site cleanup and landscaping to restore vegetation cover after construction is completed.	• WBG Environmental, Health, and Safety (EHS) Guidelines • WBG EHS Guidelines: Construction and Decommissioning • WBG Environmental, Health, and Safety Guidelines for Railways	• Occupational Health and Safety Plan (OHSP) • Pollution Prevention Plan – Water and Wastewater Management •
9.	Surface water quality	Construction	Construction activities on hydrology	• Ensure temporary construction roads built over the affected rivers are removed and the site area is cleaned up of construction debris and general waste after construction.		
10.	Surface water quality	Operation	Railway operation on surface water quality	• Mandatory compliance of activities within protected shoreline belts and water protection zones with national laws and regulations.		
11.	Surface water quality	Operation	Railway operation on hydrology	• Mandatory compliance of activities within protected shoreline belts and water protection zones with national laws and regulations. • Drainage control plans to manage potential flooding. At the time of writing, no drainage control plans were available.		

12.	Soil quality	Construction	Soil cover and vegetation fertility	• Removal and storage of fertile soil:
				  ○ Ensure strict monitoring during the removal of the fertile soil layer across the site.
				  ○ Store the removed soil in designated areas for later use in landscaping.
				  ○ Before excavation, the upper fertile soil layer should be removed and stored nearby. After backfilling, the soil should be levelled over the filled trenches.
				• Site Cleanliness:
				  ○ Regular cleaning of the construction and installation site will be conducted.
					• WBG Environmental, Health, and Safety (EHS) Guidelines
					• WBG EHS Guidelines: Construction and Decommissioning
					• WBG Environmental, Health, and Safety
						• Occupational Health and Safety Plan (OHSP)
						• Pollution Prevention Plan –
						• Water and Wastewater Management

No.	Aspect	Phase	Impact / Activity	Embedded controls description	Relevant Guidelines / Source of GIIP	Related Management Plan
				◦ Workplaces will be equipped with containers for household and construction waste. ◦ Clearing littered areas of all waste. ◦ Ensure proper disposal, storage, and transportation of household and technological waste. • Roads and Accessibility: ◦ Temporary roads and access points will be constructed prior to work commencement, adhering to guidelines to prevent damage to trees and shrubs. ◦ Restrict the movement of construction equipment and vehicles to access and internal roads only. ◦ Utilisation of Vehicles with Low Tire Pressure. • Fuelling and Equipment Maintenance: ◦ Refuelling of construction equipment will be conducted at stationary fuelling points. ◦ Construction machinery will undergo regular technical inspections and repairs to prevent soil contamination from fuel and lubricants. ◦ Operate vehicles and machinery in good technical condition to reduce pollutant emissions and prevent environmental degradation. • Rehabilitation, preservation and restoration: ◦ Rehabilitating disturbed lands and adjacent plots impacted by construction activities. ◦ Restoring soil and vegetation through the creation of herbaceous communities, which will compensate for environmental damage caused by vegetation loss, soil disturbance, habitat disruption, hydrological changes, and pollution. ◦ Reclamation will ensure soil contamination is eliminated, and stored soil will be reused for project needs.	Guidelines for Railways	
13.	Soil and groundwater quality	Construction	Soil and groundwater quality	• Compliance with environmental legislation: ◦ Subsoil use must align with the environmental legislation of the Republic of Kazakhstan. ◦ Adhere to national laws to prevent harmful anthropogenic processes. ◦ Protection measures should address risks from natural factors like flooding and fires. ◦ Compliance with rules related to environmental protection. ◦ Compliance with the conditions of environmental and other permits. • Mitigation measures for construction activities: ◦ Irrigation and Dust Control: Use irrigation as needed to control dust from open soil and loose materials. ◦ Excavated Materials Management: Excavated soil, garbage, and sludge will be transported to designated disposal sites. Excess soil will be used for backfilling or removed to approved locations. ◦ Transport Best Practices: Ensure that soil, debris, and sludge are securely covered during transport to prevent spillage. • Waste handling and storage: ◦ Construction Waste: Temporary storage of construction waste on-site before disposal or reuse. Excess soil will be removed to designated areas such as ravines or gullies. ◦ Solid Domestic Waste: Store waste (paper, plastic, food, etc.) in designated containers on hard-surface areas. Waste will be regularly removed and transported to landfill sites. Littering, burning, or burying waste on-site is prohibited.	• WBG Environmental, Health, and Safety (EHS) Guidelines • WBG EHS Guidelines: Construction and Decommissioning • WBG Environmental, Health, and Safety Guidelines for Railways	• Occupational Health and Safety Plan (OHSP) • Pollution Prevention Plan – Water and Wastewater Management

No.	Aspect	Phase	Impact / Activity	Embedded controls description	Relevant Guidelines / Source of GIIP	Related Management Plan
				○ Fuel and Equipment Maintenance: Ensure that equipment is in good condition to prevent leaks of fuel and lubricants. Faulty equipment should not be used. ○ Washing of Equipment: Washing of vehicles and equipment on-site is strictly prohibited. ○ Wastewater: no industrial or domestic wastewater to be discharged into surface or groundwater sources, minimising the risk of contamination. • Soil Conservation and Land Management: ○ Post-Construction Cleanup: Ensure the site is cleared of construction and household waste after project completion.		
14.	Soil and groundwater quality	Construction	Soil and groundwater quantity	• To ensure reliable supply, stations for first and second lifting are planned, with differing capacities and dimensions to suit site-specific requirements. This plan ensures sufficient water availability throughout the construction phase, with minimal disruption to local groundwater resources.		
15.	Soil and groundwater quality	Operation	Soil and groundwater quality	• Compliance with Environmental Legislation: ○ Land Use Compliance: Avoid encroachment on water fund lands. ○ Environmental Compliance: Adhere to directives from environmental authorities to reduce water consumption and pollutant discharge. ○ Adhere to national laws to prevent harmful anthropogenic processes. ○ Protection measures should address risks from natural factors like flooding and fires. • Waste Handling and Storage: ○ Wastewater Management: Prohibit industrial and stormwater discharge into surface water bodies. ○ Waste Management: Enforce protocols for the proper disposal of chemical waste and wastewater. ○ Sanitation: Maintain proper sanitary conditions at the construction and operational sites. • Contamination prevention: ○ Equipment Maintenance: Ensure all machinery and equipment are in good working condition to prevent leaks and spills. ○ Hazardous Material Management: Implement strict controls on hazardous materials to prevent contamination. ○ Containment Systems: Install spill containment and runoff management structures to mitigate accidental pollution. ○ Monitoring: Regularly monitor soil and water quality along the railway corridor. ○ The availability and technical condition of equipment for the localisation and elimination of the consequences of man-made accidents.		
16.	Soil and groundwater quality	Operation	Soil erosion and seismic risk	• The Project design has considered the relevant national regulatory requirements related to seismic design risk assessment and soil erosion and the findings of the site-specific geological investigation study.		
17.	Biodiversity	Construction	Generic controls	• Regulations & Requirements ○ Compensatory planting: 10 trees must be replanted for each tree felled in urban areas and settlements. ○ KTZ must conduct a tree inventory and develop a replantation project post-construction.	• WBG Environmental, Health, and Safety (EHS) Guidelines	• Biodiversity Management Plan (BMP)

No.	Aspect	Phase	Impact / Activity	Embedded controls description	Relevant Guidelines / Source of GIIP	Related Management Plan
				◦ The project must be reviewed by the Committee of Forestry and Wildlife for permit approval. • Exceptions & Specifics for Railway Alignment ◦ The 10:1 replanting rule does not apply to railway routes. ◦ KTZ is only required to replant trees along both sides of the railway. ◦ Required tree specifications: deciduous seedlings (≥2.5m height, ≥3cm trunk diameter at 1.3m height). ◦ Shrubs like Zhuzgun must be planted 50m away from rails for safety. • Planting Distribution (Total: 125,410 plantings) ◦ 104,610 trees, 20,800 shrubs. ◦ By district: ◦ Zhambyl: 8,270 ◦ Karasai: 8,920 ◦ Ili: 100,200 ◦ Talgar: 8,020 • Maintenance & Implementation ◦ 3-year maintenance and protection required. ◦ Failed plantings must be replaced. ◦ Planting should occur within a 1km radius of the felling site or on designated public lands if space is unavailable. ◦ Landscaping organisations handle implementation. • Safety Considerations ◦ Avoid planting near/over buried 10kV lines to prevent root damage. • No planting under Overhead Lines (OHLs) to avoid interference with power infrastructure.	• WBG EHS Guidelines: Construction and Decommissioning • WBG Environmental, Health, and Safety Guidelines for Railways • IFC Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resource • Convention on the Conservation of Migratory Species of Wild Animals (CMS) • Central Asian Mammals Initiative (CAMI)	
18.	Biodiversity	Construction	Aquatic Ecology	• Ensure compliance with national laws for activities within protected shoreline belts and water protection zones. • Implement erosion control measures, such as silt fences and sediment basins, to prevent sediment runoff. • Restore disturbed areas by backfilling construction quarries, planting vegetation, and sowing perennial grass with mineral fertilisers. • Prohibit open storage, loading, and transportation of bulk dusty materials; use containers or specialised transport instead. • Preserve existing vegetation along rivers to filter runoff and reduce sedimentation. • Apply best practices for hazardous material handling and storage to prevent spills and contamination. • Dispose of fuel-lubricating materials only at designated locations. • Collect domestic wastewater in tanks for offsite treatment. • Conduct site cleanup and landscaping to restore vegetation after construction completion.		
19.	Biodiversity	Operation	Wildlife mortality risks	• The design of the Project includes installation of six (6) cattle crossings along the alignment for safe passage for animals across the railway line and reduce the risk of collisions.		
20.	Biodiversity	Operation	Habitat fragmentation, degradation and wildlife barriers	• Monitoring the flora health along the railway line to assess any long-term impacts from railway activities. • Implementing measures to control and manage invasive plant species that may threaten native flora in the vicinity of the railway line. • Developing restoration plans post-construction including replanting native species. •		

No.	Aspect	Phase	Impact / Activity	Embedded controls description	Relevant Guidelines / Source of GIIP	Related Management Plan
21.	Climate	General Design	Extreme Heat - Physical damage to assets	• During the rail design phase, temperature fluctuations are considered, and the current design can endure extreme heat exceeding 120°C. • The rail surface is treated with a specialised coating designed to enhance thermal resistance and durability. • Equalising rails have been implemented to facilitate controlled expansion/contraction, thereby reducing stress on the track. Additionally, an expansion gap of 4-5 mm has been established to mitigate damage caused by heat-induced changes. • To ensure track safety and structural integrity, thermal monitoring is already in place, including an ultrasonic flaw detection technique that helps identify internal cracks within the rails. • Additionally, mobile diagnostic units with thermometers are also in place to monitor temperatures continuously, detecting excessive heat buildup that could lead to rail expansion, buckling, or misalignment. • As per the requirement, refrigerated containers are used for temperature-sensitive goods. • To prevent overheating of key infrastructure components (like signals and power systems), materials were selected to endure high temperatures, ensuring that they remain functional even in extreme heat conditions.	• WBG Environmental, Health, and Safety (EHS) Guidelines • WBG Environmental, Health, and Safety Guidelines for Railways • IPCC GHG inventory guidelines for mobile, stationary combustion, and wastewater treatment	• Embedded in Project design.
22.	Climate	Construction	Extreme Heat – Impacts on workers	• To ensure workers' safety, work hours are thoroughly regulated during the peak hot season, e.g., heavy labour work is scheduled for early mornings and late evenings, while less intensive or sheltered tasks are carried out during the hottest part of the day. This framework is fully compliant with Kazakhstan's labour laws, prioritising both safety and legal adherence.		• Occupational Health and Safety Plan (OHSP) Contractor Management Procedures (CMP)
23.	Climate	General Design	Extreme Cold - Physical damage to assets	• Considering harsh continental climate conditions, extreme temperatures were already factored into the infrastructure's resilience. • Materials were selected to endure extreme temperatures, and functionality is unaffected up to ±120°C. • Thermal monitoring, including an ultrasonic flaw detection technique that helps identify internal cracks within the rails, is already in place to ensure track safety and structural integrity. • Equalising rails have been implemented to facilitate controlled expansion/contraction, thereby reducing stress on the track. • As required, insulated/heated containers are used for temperature-sensitive goods. • The rail surface is treated with a specialized coating to enhance thermal resistance and durability.		• Embedded in Project design.
24.	Climate	Construction	Extreme Cold – Impacts on workers	• Work hours are thoroughly regulated during peak cold conditions to ensure workers' safety, which complies with Kazakhstan's labour laws.		• Occupational Health and Safety Plan (OHSP) • Contractor Management Procedures (CMP)
25.	Climate	General Design	Flooding - Physical damage to assets	• The railways were constructed on an embankment. • Culverts are in place to manage water flow, and bridges were built for river crossings. • To enhance stability, train tracks are slightly raised and supported by a foundation of sand and soil. • To prevent waterlogging, drainage infrastructure is in place on both sides of the railway tracks to redirect water to the adjacent fields. • Ballast reinforcement, soil stabilisation, and vegetation processes have already been implemented to minimise soil erosion.		• Embedded in Project design. • Occupational Health and Safety Plan (OHSP) • Emergency Preparedness and Response Plan (EPRP)

No.	Aspect	Phase	Impact / Activity	Embedded controls description	Relevant Guidelines / Source of GIIP	Related Management Plan
				• Ensuring the safety of both rail transport and pipelines, railway tracks were already elevated between 2.5m to 3m at locations where they intersect with pipelines, whereas the bridges were constructed at a height of 18m to 19m. • The contingency plan is already in place for emergencies like eroded tracks; temporary reinforced rails are installed to allow trains to pass under strict safety conditions.		
26.	Climate	General Design	Flooding - Impacts on workers	• To ensure safety, workers are prohibited from engaging in tasks in flood-prone areas.		• Occupational Health and Safety Plan (OHSP) • Contractor Management Procedures(CMP) • Emergency Preparedness and Response Plan (EPRP)
27.	Climate	General Design	Wildfires - Physical damage to assets	• In case of emergency, measures like deployment of fire trains at the Site are already in place. • To prevent wildfires, the dry vegetation or wood along the tracks is burnt in a controlled manner. • No fire detection system/sensors are in place. Currently, the train drivers of passing trains inform the station masters of the nearest station about the fires. • Fire extinguishers, both stationary and mobile, are in place on-site to prevent fires. • Further, to enhance safety measures, fire-resistant materials, particularly concrete, are used for construction purposes.		• Occupational Health and Safety Plan (OHSP) • Emergency Preparedness and Response Plan (EPRP)
28.	Climate	General Design	Wildfires - Impacts on workers	• To ensure safety, workers are prohibited from engaging in tasks in affected areas.		• Occupational Health and Safety Plan (OHSP), • Emergency Preparedness and Response Plan (EPRP) • Contractor Management Procedures (CMP)
29.	Social	Pre-construction	Land Use: Alignment of Railway Bypass	• Five (5) different options for the alignment of the railway route considered as described in **Section 2.** Final alignment decision included considerations of community impacts such as reducing disruptions to populated areas and existing settlements, minimisation of earthworks to avoid livelihood impacts and minimising impacts to land use planning by considering Almaty's General Plan for suburban zones.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways	• Embedded in Project design.

30.	Social	Pre-construction	Physical Displacement of Landowners and Users	• Avoidance of Impacts Through Alignment Optimisation:
				    ○ To minimise displacement impacts, the Project alignment was selected based on an optimisation process that considered five different route options. See above point.
				• Compliance with Kazakhstan's National Expropriation Laws, which includes:
				    ○ Issuance of an expropriation decree and public notification of affected landowners.
				    ○ Valuation of affected land and assets by state-licensed valuators engaged by District Akimats.
				• Provision of Compensation in Accordance with National Regulations
					• WBG Environmental, Health, and Safety (EHS) Guidelines
					• IFC Environmental, Health, and Safety Guidelines for Railways
					• IFC PS5 Land Acquisition and
						• Embedded in Project design.
						• Stakeholder Engagement Plan (SEP) and Grievance Redress Mechanism (GRM)
						• Livelihood Restoration Plan (LRP)/ Resettlement Framework (RF)

No.	Aspect	Phase	Impact / Activity	Embedded controls description	Relevant Guidelines / Source of GIIP	Related Management Plan
				◦ Physically displaced landowners are compensated for the loss of their residential structures based on valuations conducted by state-licensed appraisers. ◦ Compensation mechanisms include either: ▪ A replacement land plot (where applicable), or ▪ Monetary compensation equivalent to the assessed value of the affected land and assets. (Refer to LRP-RF for monetary compensation details). • Notification and Relocation Process ◦ Affected landowners have been notified through official decrees, written notices, and direct communication from Akimats and KTZ representatives. ◦ In accordance with national laws, physically displaced households must vacate their properties only after compensation has been paid. ◦ Unless otherwise agreed with the Akimat, the earliest at which a landowner or tenant can be evicted would be three (3) months from the publication of the Decree on state expropriation. ◦ In some cases, affected households have been granted extended occupancy rights by District Akimats to allow for smoother transitions.	Involuntary Resettlement	
31.	Social	Pre-construction	Economic Displacement of Landowners	• Optimisation of alignment to avoid and/or minimise social impacts: The current Project alignment was selected out of five (5) different options with the considerations of avoiding and minimising disturbances to local settlements and communities as detailed in **Section 7.4.1**. • The compensation to landowners in relation to the Project's land procurement is in line with Kazakhstan's national legislation on land expropriation for state-needs and has been assessed through state-licensed valuators engaged by District Akimats that considered the following: ◦ Standardised base rates defined by Kazakhstan's cadastre system, considering official criteria such as land use, soil characteristics, geographic region, and infrastructure development. ◦ Valuation of fixed assets on the required land. ◦ Adjustment coefficients as determined by the valuator's professional judgment, taking into consideration characteristics of the land plot such as physical condition, location and market demand.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC PS5 Land Acquisition and Involuntary Resettlement	
32.	Social	Pre-construction	Economic Displacement of Land Users	• Alignment Optimisation: see above point. • Notably, lease holders are not entitled to compensation under Kazakhstan's national legislation and regulations on land expropriation. While some leaseholders were able to obtain assistance from District Akimats in finding alternative plots of land to lease, or had their contracts adjusted to reflect the changes in leased land holdings, these were at the discretion of the district's land acquisition department.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC PS5 Land Acquisition and Involuntary Resettlement	

No.	Aspect	Phase	Impact / Activity	Embedded controls description	Relevant Guidelines / Source of GIIP	Related Management Plan
33.	Social	Pre-construction	Economic displacement impacts on commercial entities	• Alignment Optimisation: see above point. • Compensation: Compensation for procured land is aligned with Kazakhstan's national legislation. For commercial entities leasing land, the compensation is determined based on the value of their leasehold rights and any investments made in the land, including commercial assets. Respondents surveyed by ERM shared that they were able to resolve challenges faced during the land acquisition process through negotiation with the District Akimat.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC PS5 Land Acquisition and Involuntary Resettlement	
34.	Social	Pre-construction	Workers facing loss of employment due to land acquisition	• There are no Project-specific embedded controls for workers facing a loss of employment due to the Project's land procurement. • However, the Project's procurement policy, as aligned with Kazakhstan's national laws, obligates it to procure and employ locally where possible.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC PS2 Labour and Working Conditions	• Contractor Management Procedures (CMP)
35.	Social	Pre-construction	Local Settlements along the Alignment	• Construction of cattle underpasses: six (6) concrete bridges were planned to be constructed as part of the Project design, serving as cattle overpasses to minimise impacts of land fragmentation on grazing due to the Project. • One (1) railway overpass was also designed to provide passage for agricultural machinery along the alignment. • The Project design also provided four (4) railway overpasses to bridge existing roads affected by the alignment construction which were designed for vehicular traffic.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC PS4 Community Health, Safety, and Security	• Embedded in Project design.
36.	Social	Construction	Labour and Working Conditions	• The Project is obligated to procure and employ locally where possible, in accordance with the Procurement Procedure of Samruk-Kazyna JSC, the state-holding company that oversees KTZ, per the Law on Procurement of Certain Subjects of the Quasi-Public Sector (2021). The risk of discrimination in the workplace is low due to the low numbers of migrant workers (if any) present in the workforce. • The Project complies with the requirements of SN RK 1.03-05-2011 "Occupational Health and Safety in Construction." This includes the provision of personal protective equipment (PPE), measures for collective protection of workers, and adherence to safety regulations for work practices. • Accommodation standards for workers include sanitary facilities and devices that will be provided before the start of construction and installation works at the facility. • Prior to the commencement of construction, the customer and the general contractor, alongside subcontractors, are required to issue an admission certificate. This certificate specifies the safety measures that must be	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC PS2 Labour and Working Conditions	• Occupational Health and Safety Plan (OHSP) • Contractor Management Procedures (CMP)

No.	Aspect	Phase	Impact / Activity	Embedded controls description	Relevant Guidelines / Source of GIIP	Related Management Plan
				implemented and holds construction organisation heads responsible for these measures. • Before starting work in conditions of industrial risk, the Project mandates the identification of areas that are hazardous for people, including locations near uninsulated current-carrying parts of electrical installations, unguarded height differences, and places where harmful production factors may exceed permissible levels. • For areas with hazardous production factors, work permits must be issued for the execution of high-risk work, ensuring stringent safety measures are in place prior to commencing such activities. • Heads of construction and installation organisations are required to organise labour safety training for workers before they are admitted to work, ensuring that all personnel are adequately informed of safety protocols and practices. • The construction site will include clear signage for driveways and passages to promote safety, and danger zones will be fenced and marked with warning signs and inscriptions at all times. • The Project will designate areas for first aid kits and emergency response equipment, ensuring that workers have access to necessary medical support. • All workers on the site will be provided with drinking water that meets sanitary requirements, along with adequate sanitary facilities to ensure health and hygiene at the construction site. • Adequate illumination will be provided for work sites, workplaces, and passages, in line with the "Instructions for the design of electric lighting of construction sites." • An access control system (ACS) will be implemented to monitor the entry and exit of personnel, restricting access to unauthorized individuals and ensuring that only qualified personnel are present on site.		
37.	Social	Construction	Community Health and Safety	• ERM found on site that the responsibility for security rests with each subcontractor; and that the proponent of the Project, KTZ, has no oversight on the use or hiring of security guards. Information received from KTZ suggests no security agency is formally contracted and there are no armed security guards in the Project area. • According to one of the subcontractors interviewed by ERM, there is no formal, written code of conduct for subcontractors. Rather, they are bound by an Admission Order signed between KTZ and the contractor. An Admission Order typically refers to an official document or directive that allows a subcontractor or their workers to access a construction site and commence their contracted duties. It is often part of the formalized procedures to ensure compliance with safety, regulatory, and contractual obligations on a construction project.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC PS4 Community Health, Safety, and Security	• Occupational Health and Safety Plan (OHSP) • Contractor Management Procedures (CMP)
38.	Social	Operation	Labour and Working Conditions	• Security: While information on the security arrangements for the Project operations was not yet available, it is likely that security personnel will be employed at stations or in situations where precious cargo is transported. KTZ is to develop a Security Management Plan aligned with Performance Standard 4 (PS 4) to ensure that security measures are implemented in a proportionate manner and adhere to international best practices. This policy should govern the recruitment, conduct, training, equipment, and oversight of security personnel while ensuring compliance with applicable laws. • Labour management: According to one of the subcontractors interviewed by ERM, there is no formal, written code of conduct for subcontractors. Rather, they are bound by an Admission Order signed between KTZ and the contractor. An Admission Order typically refers to an official document or directive that	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC PS2 Labour and Working Conditions	• Occupational Health and Safety Plan (OHSP) • Contractor Management Procedures (CMP) • Security Management Plan

No.	Aspect	Phase	Impact / Activity	Embedded controls description	Relevant Guidelines / Source of GIIP	Related Management Plan
				allows a subcontractor or their workers to access a construction site and commence their contracted duties. It is often part of the formalized procedures to ensure compliance with safety, regulatory, and contractual obligations on a construction project. • Fire risk: Currently, fire detection systems are not installed along the railway corridor. Fire incidents rely on train drivers reporting to the nearest station master. • Wildfire risk management: The existing approach involves controlled burning of dry vegetation along railway tracks and deployment of fire trains.		
39.	Social	Throughout Pre-Construction, Construction and Operation	Gendered impacts on women, including risks of gender-based violence	• There are no known project-specific embedded controls with a focus on gendered impacts on women. • The Project relies on national legislation to address such concerns. Notably, in April 2024, Kazakhstan's President Kassym-Jomart Tokayev signed a law criminalising domestic violence, reinstating battery and light bodily harm as criminal offenses, which had been decriminalized in 2017. Consultations with women in the community indicated that most were aware of the recent passing of this legislation criminalising domestic violence in Kazakhstan and cited it as an improving situation for women in general due to the increased legal protections that victims are entitled to. This awareness reflects the law's significant public attention, partly due to high-profile cases and national discussions on the issue. • Safety and traffic related management policies and considerations are gender-agnostic.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC PS4 Community Health, Safety, and Security	• Stakeholder Engagement Plan (SEP) and Grievance Redress Mechanism (GRM)

9.4.2.2 ESIA MITIGATION MEASURES

Table 9-3 and **Table 9-4** summarise the key environmental and social impacts associated with both the pre-construction/construction and operation of the Project, along with additional mitigation measures (beyond the embedded controls) to minimise the remaining impacts. For each issue, the mitigation measures are outlined, along with the specific actions required for their implementation and the parties responsible for carrying them out.

Mitigation Measures – Pre-Construction / Construction Phase

TABLE 9-3: SUMMARY OF MITIGATION MEASURES – PRE-CONSTRUCTION / CONSTRUCTION PHASE

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
1.	Air quality	Dust from construction activities	• The following mitigation measures should be conducted at Kazybek Bek Station and are **GIIP** for other stations and along the alignment: • Dust suppression by watering of open construction sites during earthworks and bulk construction materials to minimise airborne PM at a greater frequency than currently practiced must be adhered to. During the warm season, watering should be done every four (4) hours (including in the morning before starting work and at the end of the day). On particularly hot, dry and windy days, watering should be done every two (2) hours according to the recommendations of the IFC EHS Guidelines. Visual checks should be undertaken and if needed, additional dust suppression added as required if visible dust blow is obvious form any activity. • Construction machinery and vehicles to strictly follow designated temporary access routes and adhere to speed limits on access roads without hard surfacing must be adhered to. The project should prepare a Traffic Management Plan if traffic flows are potentially significant (as determined by the screening values provided) with responsibilities and monitoring of compliance, further details can be found in the Construction ESMS (separate file). • Mulch or cover areas of occasional or no construction traffic within the sites.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC EHS Guidelines: Construction and Decommissioning • IFC Environmental, Health, and Safety Guidelines for Railways • WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulphur Dioxide. • Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction • ISO 14001:2015 - Environmental management systems • USEPA's 40 CFR Part 1039 (Nonroad Engine Regulations) and 40 CFR Part 86 (Heavy Duty Vehicle Regulations)	• Site inspections • Semi-annual audits • Environmental monitoring • Records and reports	• Pollution Prevention Plan – Air Emissions Management • Occupational Health and Safety Plan (OHSP)	• Visually inspect for airborne dust and dry areas •	• EPC and construction subcontractors • Third party monitoring subcontractors
2.	Air quality	Traffic exhaust	• The following **GIIP** are recommended: • Regularly carry out preventive engine maintenance of construction machinery and vehicles. Recommendations according to IFC EHS Guidelines, US EPA and ISO 14001: o Heavy Equipment (e.g. Excavators, Dozers): Every 250-500 hours of operation (or every 3-6 months) depending on operating conditions. o Light Vehicles: Every 5,000-10,000km or as recommended by the manufacturer. • Carry out regular engine exhaust tests for construction machinery and motor vehicles (at least annual scheduled tests and after every engine overhaul or adjustment). Recommendations according to IFC EHS Guidelines, US EPA and ISO 14001: o Annual Testing: At least once a year for all construction equipment. o After Engine Repair or Adjustment: Emissions testing is mandatory after major engine repairs, component replacements or calibrations. o Heavy Duty: Under heavy loads, testing every six (6) months is recommended. • Do not use machinery/vehicles, which were not subject to technical inspection and exhaust gases testing. Appoint a					

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
			responsible person to monitor the technical readiness of the contractors' and the Company's machinery/vehicles for construction work.					
3.	Noise	Construction Noise	Develop a construction noise management plan that includes the following measures: • Locating stationary equipment in acoustically treated enclosures, where practicable. • Lining chutes and bins with damping material. • Installing noise mufflers such as tubular, plate, cylindrical, or chamber air ducts lined with sound-absorbing materials for ventilation systems as per manufacturer recommendations. • Installing temporary construction noise barriers along the border of the right-of-way (e.g., earthen mounds, walls, and vegetation).	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC EHS Guidelines: Construction and Decommissioning • IFC Environmental, Health, and Safety Guidelines for Railways • WHO Guidelines for Community Noise • USFTA Transit Noise and Vibration Impact Assessment Manual • ISO 14001:2015 - Environmental management systems	• Site inspections • Semi-annual audits • Records and reports •	• Pollution Prevention Plan – Noise and Vibration Management • Occupational Health and Safety Plan (OHSP)	• Quarterly Monitoring at residential areas near the construction site and transport roads	• EPC and construction subcontractors • Third party monitoring subcontractors • •
4.	Noise	Noise from blasting activities	• Scheduling blasting activities during daytime to minimise potential impacts on the surrounding areas. • Optimising the number of holes blasted per shot and the total charge per blast. • Monitoring noise and vibration during blasting activities. • Using noise barrier / screen at the blasting site perimeter. • Conduct routine inspections and monitoring, including regular culvert checks and regular cleaning (minimum quarterly).					
5.	Soil & Groundwater quality	Construction activities on soil & groundwater quality	• Considering the large volume of earthworks involved, the project should undertake visual observation (noting that not every contamination is visible such as heavy metal) and conduct sampling and Laboratory analysis of imported fill material if red flags are found to minimise potential contamination risks.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC EHS Guidelines: Construction and Decommissioning IFC Environmental, Health, and Safety Guidelines for Railways	• Site inspections • Semi-annual audits • Environmental monitoring • Records and reports	• Pollution Prevention Plan – Water and Wastewater Management Plan • Occupational Health and Safety Plan (OHSP) • Stormwater and Erosion Control Plan • Water quality management plan	• Water sampling	• KTZ • EPC and construction subcontractors • Third party monitoring subcontractors
6.	Biodiversity [343]	Fencing and Barriers[344]	• Fencing Placement: Temporary fencing should be installed only where strictly necessary, particularly around active	• WBG Environmental,	• Site inspections			• KTZ

[343] To support the effective implementation of the recommended biodiversity mitigation measures and the Biodiversity Management Plan, it is recommended that the Project hire an ecologist. The ecologist will oversee and monitor the application of these measures, ensure the BMP is executed as planned, and suggest updates based on site-specific observations and findings.
[344] Convention on the Conservation of Migratory Species of Wild Animals (CMS) and Central Asian Mammals Initiative (CAMI). (2020). Mitigating the impact of linear infrastructure on migratory mammals in Central Asia: Guidelines and recommendations. Wildlife Conservation Society. https://www.cms.int/sites/default/files/publication/cms-cami_pub_linear-infrastructure_wcs_e.pdf

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
			quarries and large trenches, to mitigate fall and entrapment risks for target species. • Prompt Removal: Fencing must be removed immediately once it is no longer needed to prevent the creation of unnecessary barriers that disrupt wildlife movement. • Fence Height & Structure: The height of the fence should not exceed 1.2 meters (4 feet) to ensure that medium-sized mammals, such as foxes, can see the barrier clearly and avoid injury. • Buried Mesh: To prevent species such as foxes and the Central Asian tortoise from burrowing underneath, the fence must include a buried component. Bury the fence at least 30 cm (12 inches) below ground, angled outward at 90 degrees, to block animals from digging beneath the structure. • The lower portion of the fence should be smooth and free of sharp edges to prevent the Central Asian tortoise from becoming trapped or injured. Regular inspections should be conducted to ensure no animals are caught along the base of the fence. Visibility Markers: High-visibility markers (e.g., flags or reflective materials) should be incorporated at regular intervals to enhance the visibility of the fencing for wildlife and reduce the risk of accidental collisions. Wildlife Escape Ramps: Provide escape ramps or graded areas around trenches and quarries, allowing tortoises and other wildlife to exit safely if they become trapped within fenced areas. Structural Integrity: The fence should be constructed using sturdy materials to maintain upright positioning and reduce the risk of collapse. Loose fencing materials or posts can impede wildlife movement and should be avoided. • Maintenance Schedule: A routine maintenance schedule must be established, including adequate budget provisions to ensure the long-term functionality of the fence. Deterioration of the structure can result in wildlife injuries or mortality, so prompt repairs are essential. • Vehicle Speed Limits: All vehicles operating in the fenced areas should adhere to a maximum speed limit of 20 km/hr to minimise the risk of wildlife-vehicle collision.	Health, and Safety (EHS) Guidelines • IFC EHS Guidelines: Construction and Decommissioning • IFC Environmental, Health, and Safety Guidelines for Railways • IFC Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resource • Convention on the Conservation of Migratory Species of Wild Animals (CMS) • Central Asian Mammals Initiative (CAMI)	• Semi-annual audits • Records and report	• Biodiversity Management Plan (BMP) • Pollution Prevention Plan – Water and Wastewater Management Plan • Stormwater and Erosion Control Plan • Water quality management plan	• Excavations shall be inspected daily. • Regular monitoring shall be conducted. •	• Integra and construction subcontractors
7.	Biodiversity	Vegetation Clearance	• Tree Inventory Assessment: Conduct a comprehensive tree inventory prior to any tree felling activities. Document the species and size of all trees within the project area to facilitate informed decision-making during felling and future restoration activities. • Timing of Felling Activities: Schedule tree felling activities outside the autumn migratory season and the breeding season for local avian fauna whenever feasible. This minimises disruption to migratory patterns and nesting behaviours of birds. • Pre-Felling Inspection: Engage a qualified local ecologist, naturalist, or an organisation with expertise in local biodiversity to conduct inspections of all trees designated for felling. Assess the trees for the presence of avifauna nests,					

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
			mammals, herpetofauna, and any other fauna that may inhabit the trees. • Monitoring for Fauna Presence: If the presence of mammals, herpetofauna, birds, or bats is detected, postpone tree felling or transplanting until the animal vacates the tree voluntarily. Implement a waiting period if necessary to ensure the animal has left the area. • Protection of Active Nests: Ensure that if active nests are identified on any tree, the nests remain undisturbed until nesting activities are complete, meaning the young have fledged. Tree felling or transplanting should only be conducted after verifying that no active nests are present. • Post-Felling Fauna Inspection: Following tree felling, a qualified individual (ecologist/naturalist) or organisation should thoroughly inspect the fallen tree for any injured or trapped fauna that may have gone unnoticed. If any injured or trapped animals are found, provide immediate veterinary care as needed. Documentation and Reporting: Maintain records of all inspections, findings, and actions taken regarding tree felling, including any incidents involving wildlife. This documentation should be made available for future reference.					
8.	Biodiversity	Rescue and rehabilitation procedures	• A detailed procedure should be developed, outlining steps to manage wildlife incidents within the project area. Staff must undergo regular training to ensure familiarity with the rescue and rehabilitation protocols in place. • Animal Entrapment or Presence on Site: If an animal is found trapped in an excavated area, encountered accidently (e.g., Central Asian tortoises, which were found during the current excavation due to their tendency to burrow in sandy or loamy soils for hibernation or shelter) or enters the project site, the local wildlife and forestry department should be contacted immediately to initiate a formal rescue. Untrained personnel should be prohibited from approaching or attempting to rescue animals, even if the animal appears distressed, as this may cause harm to both the animal and staff. • Incident Documentation and Reporting: A detailed log must be maintained for all wildlife encounters, including animals that become trapped, are accidentally discovered, or are observed during construction activities. Akimats should be kept informed of any wildlife encounters. The log should capture the species involved/observed, the condition of the animal, the date, time, and exact location of the incident/observation, as well as any relevant circumstances. Photographic evidence should be collected where possible. This information must be promptly reported to the Project Manager, Construction Superintendent or Senior Environment or HSE Manager (or equivalent). Additionally, consultation with the local wildlife department or subject matter experts should be initiated as required. • Involvement of Project Personnel in Rescues: Project personnel may only participate in rescue operations if					

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
			requested by the local wildlife department, and any actions taken must be under their direct supervision and guidance. The client may also consider identifying a local ecology expert to assist with rescue efforts. • Health and Safety Protocols: Any project staff involved in handling animals, whether for rescue or disposal of deceased animals, must use appropriate personal protective equipment (PPE) such as disposable gloves and masks. Given the prevalence of rabies in the region, all personnel handling animals should be vaccinated and thoroughly briefed on associated risks. After handling animals, staff must wash and sanitize their hands thoroughly. o Post-Incident Protocol: ▪ Follow-Up: The Senior Environment / HSE Manager (or equivalent) must follow up with the Forest Department or a veterinarian to monitor the condition of the rescued animal and confirm the date of its release back into the wild. ▪ Incident Investigation: The Senior Environment / HSE Manager (or equivalent) will investigate incidents that result in injury or death of wildlife. The investigation should include the following steps: • Interview workers or eyewitnesses present on the site to gather observations. • Identify the activities that could have led to the injury or death of the animal. • If the injury is linked to project activities, determine and implement corrective actions to prevent future occurrences in coordination with the Process Senior Executive. • Dissemination of Corrective Actions: The Senior Environment / HSE Manager (or equivalent) should communicate the corrective actions to all staff and discuss them during daily meetings to ensure widespread understanding and compliance.					
9.	Biodiversity	Sediment control and monitoring	• Implement silt fences, sediment traps, or barriers around exposed soil areas and stockpiles to prevent sediment runoff into nearby water bodies. • Ensure that drainage systems are designed and maintained to handle runoff and prevent sediment transport into waterways. • Develop a water quality monitoring and erosion control plan in compliance with regulatory requirements and best practices. • Implement corrective actions if monitoring results indicate elevated sediment levels, such as reinforcing sediment control barriers or adjusting site management practices.					

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
10.	Biodiversity	General construction	• No hunting, trapping or injuring of local fauna should be communicated to the workforce through a workshop or formal training exercise. • Identify sensitive receptors during the tree inventory period (mentioned above) such as breeding grounds, and nearby residential areas. The client may also consider identifying a local ecology expert to identify sensitive receptors. • Schedule construction activities to minimise disturbances during critical periods, such as breeding and migratory seasons for local fauna. • Install temporary noise barriers or acoustic screens around construction sites to attenuate sound levels near identified active breeding grounds or nests. • Regularly maintain equipment to ensure optimal performance. • Limit the use of noisy activities to specific times of the day, avoiding early morning and late evening hours. • Continuously monitor noise and vibration levels during construction to ensure compliance with established regulatory thresholds. • Set routes, consolidation of trips and no off-roading policies should be introduced by the EPC contractor to reduce the impact. • Topsoil that is disturbed should be stored separately for later restoration of the habitat for both compensatory afforestation and compensation of loss of natural habitat. • All vehicles transporting loose materials must be covered with tarpaulins to prevent dust spread and material loss. Minimise drop heights during loading/unloading operations. • Native tree/shrub species should be seeded in disturbed areas during the monsoon season. • Simultaneous revegetation with native species should be practiced in areas that are determined to have loose or unstable soil to avoid erosion. • Additional areas in consultation with Forestry and Wildlife Department should be identified where native plantation can be undertaken based on regulatory requirements and best practices. • Hazardous materials should not be stored near natural drainage channels. • Waste materials should be cleared in a timely manner and the use of artificial lights should be minimised to not attract wildlife. • Proper sanitation facilities should be provided at the labour camps. • Labour movement should be restricted between construction camps and construction sites. Labour movement should be restricted in areas where no construction activity is planned. • General awareness regarding fauna should be practiced through training, posters, etc. among the staff and labourers.					

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
11.	Biodiversity	Managing Invasive Alien Species (IAS)	• Conduct an assessment to identify existing IAS on site. • Source fill soil and construction materials from reputable suppliers to minimise the risk of introducing IAS. • Train personnel on IAS identification and prevention practices, including checking for seeds and plant fragments. • Limit access to construction sites to essential personnel only and establish designated access routes. • Where possible machinery and equipment should be cleaned of soil prior to being mobilized to the site. Waste from vehicle washing facilities has the potential to contain seeds or fragments from IAS and should be disposed of appropriately. • Restoration plans, including those for quarry sites such as the one observed, should prioritise the use of native plant species to outcompete IAS. • Regularly monitor the site for signs of IAS during and after construction. • Develop the planned restoration activities prioritising the use of native plant species to outcompete IAS.					
12.	Biodiversity	Aquatic Ecology	• Previously recommended mitigation measures for vegetation clearance, rescue and rehabilitation should be implemented.					

13.	Social	Physical displacement of Landowners and users
		
		(pre-construction / planning phase)
			• Ensuring Compensation Reflects Full Replacement Cost
			  o Provide additional financial support to cover transaction fees, relocation costs, and any gaps in state-determined compensation.
			  o Engage an independent valuator to verify whether compensation is sufficient for securing comparable housing.
			  o Where discrepancies exist, top-up payments will be made to ensure compensation meets market value.
			• Compensation and Assistance for Informal/Unregistered Occupants:
			  o In cases for which unregistered occupants are found to be physically displaced, engage with the Akimat and Land Department to waive fines where possible.
			  o Provide relocation and moving assistance to ensure they are not left without housing.
			  o Assist in identifying alternative housing with legal tenure if required.
			• Resettlement Assistance for Vulnerable Groups:
			  o Per the guidance set out in the Resettlement Framework, to implement a targeted resettlement assistance program for elderly residents with limited mobility, single female-headed households, households with disabled members and lower-income households (if identified).
			  o This includes assistance to search and secure alternate, comparable homes, additional transitional assistance (if necessary) to cover unexpected relocation expenses and ensuring that households with disabled members have access to suitable housing.
			• Verification of Additional Displacement:
				• WBG Environmental, Health, and Safety (EHS) Guidelines
				• IFC Environmental, Health, and Safety Guidelines for Railways
				• IFC PS5 Land Acquisition and Involuntary Resettlement
					• KTZ to prepare a Land Acquisition Compensation Status Report
					• Asset Inventory, to be included in the Land Acquisition Compensation Status Report prepared by KTZ
					• LRP internal and external Monitoring
					• Record and reports
						• Stakeholder Engagement Plan (SEP) and Grievance Redress Mechanism (GRM)
						• Livelihood Restoration Plan (LRP)/ Resettlement Framework (RF)
							• N/A	• KTZ for LRP and RF in coordination with the district Akimats and Almaty Regional Land Committee

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
			○ Conduct verification to determine whether additional displacement is required due to noise compliance. ○ Where possible, implement noise mitigation measures (e.g., noise barriers) instead of relocation. • Strengthening Consultation and Grievance Redressal: ○ Ensure timely and clear communication with affected households on compensation, resettlement options, and project impacts. ○ Establish a Project-Level Grievance Redress Mechanism (GRM) to resolve disputes efficiently and transparently. • Implementing Post-Resettlement Monitoring: ○ Conduct a 2-year monitoring program to assess whether displaced households have secured adequate housing and restored livelihoods. ○ Address any unresolved compensation or relocation issues that arise post-resettlement.					
14.	Social	Economic displacement of Land (pre-construction / planning phase)	• The affected landowners whose lands have not yet been acquired should be provided with either alternate land parcels with similar levels of productivity and characteristics which are well-suited to their livelihood means, along with financial assistance to prepare the land for crop cultivation or livestock rearing. However, if this is not feasible then adequate compensation at full replacement cost, as detailed in the LRP should be provided. • Livelihood restoration support may be additionally required for some affected households (vulnerable). This may be extended to those who have been compensated (land acquisition is complete) but have been found to be in the vulnerable category and may not have been able to restore their livelihoods to pre-Project levels, based on the compensation received. • Reimbursements of transaction costs and deduction of depreciation of assets, where applicable • Those who have been/or will be rendered landless or with sub-optimal land holdings after the Project's procurement of their private lands should be eligible for livelihood restoration support that may include merit-based work towards the operations phase of the Project where possible or offered other forms of transitional support as detailed in the Livelihood Restoration Plan. This assistance should be for a period of time assessed to be adequate to help sustainably restore their incomes and livelihoods to pre-project levels. • A functional GRM to address concerns related to compensation, land acquisition processes, or other associated impacts should be operational for the duration of the planning phase and also cover (as relevant) the later Project phases.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC PS5 Land Acquisition and Involuntary Resettlement	• KTZ to prepare a Land Acquisition Compensation Status Report • Asset Inventory, to be included in the Land Acquisition Compensation Status Report prepared by KTZ • LRP internal and external Monitoring • Record and reports	• Stakeholder Engagement Plan (SEP) and Grievance Redress Mechanism (GRM) • Livelihood Restoration Plan (LRP)/ Resettlement Framework (RF)	• N/A	• KTZ for LRP and RF in coordination with the district Akimats and Almaty Regional Land Committee
15.	Social	Economic displacement of Land users	• Where feasible, affected land users should be provided with alternative leased or tenant land of comparable size and productivity to restore their livelihoods.	• WBG Environmental, Health, and	• KTZ to prepare a Land Acquisition Compensation Status Report	• Stakeholder Engagement Plan (SEP) and	• N/A	• KTZ for LRP and RF in coordination with the district Akimats and

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
		(pre-construction / planning phase)	• Develop targeted support programs as outlined in the LRP, such as financial compensation, transitional allowances for vulnerable groups and support for livestock rearing to mitigate income loss. • Additional support should be provided to vulnerable groups, as detailed in the LRP. • Reimbursements of transaction costs and deduction of depreciation of assets, where applicable • A functional GRM to address concerns related to compensation, land acquisition processes, or other associated impacts, should be operational for the duration of the planning phase and also cover (as relevant) the later Project phases.	Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC PS5 Land Acquisition and Involuntary Resettlement	• Asset Inventory, to be included in the Land Acquisition Compensation Status Report prepared by KTZ • LRP internal and external Monitoring • Record and reports	Grievance Redress Mechanism (GRM) • Livelihood Restoration Plan (LRP)/ Resettlement Framework (RF)		Almaty Regional Land Committee
16.	Social	Economic displacement impacts on commercial entities (pre-construction / planning phase)	• Ensure that compensation for acquired plots is in line with the LRP, reflecting the replacement cost including the value of lost revenue, operational costs, assets and investments. • Facilitate access to alternative plots that match the productivity and strategic needs of the entities, close to existing supply chains where possible, for entities yet to be relocated. Facilitate access to additional leased plots where feasible to offset productivity losses to land plots which will be partially acquired. • Provide transitional support to cover the costs associated with relocation and operational reestablishment for entities yet to be relocated, where possible. • Assistance in providing alternate land to commercial leaseholders. • Reimbursements of transaction costs and deduction of depreciation of assets, where applicable. • A functional GRM to address concerns related to compensation, land acquisition processes, or other associated impacts, should be operational for the duration of the planning phase and also cover (as relevant) the later Project phases.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC PS5 Land Acquisition and Involuntary Resettlement	• KTZ to prepare a Land Acquisition Compensation Status Report • Asset Inventory, to be included in the Land Acquisition Compensation Status Report prepared by KTZ • LRP internal and external Monitoring • Record and reports	• Stakeholder Engagement Plan (SEP) and Grievance Redress Mechanism (GRM) • Livelihood Restoration Plan (LRP)/ Resettlement Framework (RF)	• N/A	• KTZ for LRP and RF in coordination with the district Akimats and Almaty Regional Land Committee
17.	Social	Workers facing loss of employment due to land acquisition (pre-construction / planning phase)	• Provide a six-month transition allowance aligned with the average wage of agriculture workers employed by impacted commercial entities. • Offer targeted support to vulnerable workers (e.g., women, elderly employees) to address unique challenges in finding alternative employment as outlined in the LRP. • A functional GRM to address concerns related to compensation, land acquisition processes, or other associated impacts, should be operational for the duration of the planning phase and also cover (as relevant) the later Project phases.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC PS2 Labour and Working Conditions	• KTZ to prepare a Land Acquisition Compensation Status Report • Asset Inventory, to be included in the Land Acquisition Compensation Status Report prepared by KTZ • LRP internal and external Monitoring • Record and reports	• Stakeholder Engagement Plan (SEP) and Grievance Redress Mechanism (GRM) • Contractor Management Procedure (CMP)	• N/A	• KTZ • EPC and construction subcontractors

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
18.	Social	Local Settlements along the Alignment (pre-construction / planning phase)	• Conduct community meetings to inform affected stakeholders about the locations, design, and utility of cattle underpasses and rail overpasses. • Work with Akimats to identify and allocate alternative grazing areas near the affected communities. Facilitate community-based grazing initiatives as outlined in the LRP. • For vulnerable groups such as lower-income households impacted by the loss of access to communal grazing lands, offer support for feed or supplementary grazing resources during the transition. • Seasonal or six monthly-monitoring of the adequacy of cattle passes provided by the Project in the construction and operational phase. • A functional GRM, disclosed to all affected settlements, to address concerns related to compensation, land acquisition processes, or other associated impacts, should be operational for the duration of the planning phase and also cover (as relevant) the later Project phases.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC PS5 Land Acquisition and Involuntary Resettlement	• KTZ to prepare a Land Acquisition Compensation Status Report • Asset Inventory, to be included in the Land Acquisition Compensation Status Report prepared by KTZ • LRP internal and external Monitoring • Record and reports	• Stakeholder Engagement Plan (SEP) and Grievance Redress Mechanism (GRM) • Livelihood Restoration Plan (LRP)/ Resettlement Framework (RF)	• N/A	• KTZ for LRP and RF in coordination with the district Akimats and Almaty Regional Land Committee

19.	Social	Community Health and Safety
		
		(Construction phase)
			• Traffic Management Plans
			  o Implement strict traffic management strategies during the construction phase to minimise risks associated with increased vehicle movement. This may include designated routes for construction vehicles, traffic control personnel, and scheduling deliveries to avoid peak hours.
			  o Install signage and barriers around construction sites to enhance visibility and awareness, particularly for vulnerable road users such as pedestrians and cyclists.
			• Health and Safety Protocols
			  o Establish comprehensive health and safety training for all construction workers, emphasizing safe driving, equipment operation, and emergency response procedures.
			  o Implement regular monitoring of air quality and noise levels around the construction site. If levels exceed regulatory limits, appropriate measures should be taken to reduce emissions, such as using noise barriers or dust suppression techniques.
			• Community Engagement Initiatives
			  o Conduct regular community meetings to keep residents informed about construction schedules, potential impacts, safety measures being implemented, as well as any crossings made available to them.
			  o Create a feedback mechanism for residents to report concerns or incidents related to construction activities, with a response plan in place to address these issues promptly.
			  o Health and safety risks in the vicinity of all Project components and associated facilities (when determined) should be publicly disclosed to settlements in the area, with clear directions communicated, and signs and fencing erected for hazardous areas.
				• WBG Environmental, Health, and Safety (EHS) Guidelines
				• IFC Environmental, Health, and Safety Guidelines for Railways
				• IFC PS4 Community Health, Safety, and Security
					• Site inspection
					• Reports if applicable
					• Grievance Records
					• Community stakeholder engagement reports
						• Contractor Management Procedure (CMP)
						• Occupational Health and Safety Plan (OHSP)
						• Traffic Management Plan (TMP)
							• N/A	• KTZ
								• EPC and construction subcontractors

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
			○ Develop and enforce a strict code of conduct for security personnel to ensure they engage respectfully and appropriately with community members. Supplement with training on human rights and conflict de-escalation. ○ Engage local stakeholders in discussions regarding security needs to ensure alignment with community expectations and to avoid unnecessary escalation of tensions. ○ Facilitate healthcare access for the local population by coordinating with local health services to prepare for increased demand. This may include temporary health clinics or mobile health units for direct service provision to vulnerable groups. ○ Implement vaccination and health screenings for construction workers to mitigate the risk of infectious disease spread. Healthcare providers should also promote best practices to reduce transmission of diseases. • Gender-Based Violence Prevention Programs ○ Implement awareness-raising campaigns focused on gender-based violence (GBV) targeted at both the workforce and the local community. These campaigns should inform all individuals of available services and resources. ○ Embed Gender-Based Violence and Harassment (GBVH) awareness and prevention within the worker induction briefings (including contractors and subcontractors during the operational and construction phases) by outlining the Code of Conduct, which should explicitly include the prohibition of GBVH and any form of harassment, discrimination, or inappropriate behaviour. Establish referral networks with local NGOs or service providers that specialise in addressing GBV, ensuring that affected individuals have safe access to support services. • Monitoring and Reporting ○ Establish a robust monitoring and evaluation framework to continuously assess the impacts of construction activities on health and safety. This should include regular reporting on incidents, health outcomes, and community concerns. ○ Conduct post-construction assessments to evaluate the long-term effects of the Project on community health and safety, and to adapt mitigation measures as needed for future phases.					
20.	Cultural heritage	Impact Avoidance and preparation of Kurgan Archaeological Landscape Mitigation and Management Guideline	• The Project should limit impacts to the identified cultural heritage sites and sensitivity areas of the AoI. • No project activities should occur within the demarcated 'No Go' zones, i.e. the statutory protection zone of the identified CH sites located in the AoI, including lay down areas, access tracks, and placement of temporary structures. • Ensuring good control of the works activities for management of potential impacts to cultural heritage sites following 'Kurgan	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and	• Reports if applicable	• Cultural Heritage Management Framework	• N/A	• KTZ • EPC and construction subcontractors • Margulan Institute or another licensed CH expert.

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
			Archaeological Landscape Mitigation and Management Guideline'.	Safety Guidelines for Railways • IFC PS8 Cultural Heritage				
21.	Cultural heritage	Cultural Heritage Awareness Induction	• All personnel involved with construction activities within the Project Area should undertake a cultural awareness induction prior to commencing any activities. The cultural heritage awareness induction should include: o A summary of the cultural heritage values of the AoI; o Guidance on the identification of potential CH; and o An explanation of the Chance Finds Procedure.					
22.	Cultural heritage	Chance Finds Procedure	• In the event that cultural heritage sites or materials (or suspected cultural sites or materials) are discovered during earthworks, development operations or similar activities, the procedure is to be implemented.					
23.	Cultural heritage	Public Awareness	• Disclose information during public consultations about location of cultural heritage assets which should be protected.					
24.	Cultural heritage	• Cultural Heritage Screening Checklist New works / activities being undertaken in previous undisturbed areas	• Depending on the extent of proposed works, a Cultural Heritage Impact Assessment may be required. This recommendation should be integrated into the Project's Construction Management Plan.					

Mitigation Measures – Operation Phase

TABLE 9-4: SUMMARY OF MITIGATION MEASURES – OPERATION PHASE

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
25.	Air quality	Traffic exhaust	• The following mitigation measures are required at Kazybek Bek station to verify the predicted impact significance at the station: • Conduct baseline and quarterly air quality monitoring of parameter NO_2 at the ASRs (i.e. schools) in Kazybek Bek village. • KTZ to undertake vehicle counts around Kazybek Bek Station before and during the start of the operations phase and undertake a screening exercise once this survey data is known. As part of the screening exercise, identify if there will be any need for mitigation measures.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulphur Dioxide. • Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction • ISO 14001:2015 - Environmental management systems	• Monitoring and reports	• Occupational Health and Safety Plan (OHSP) • Traffic Management Plan	• Vehicle counts	• KTZ • Operation contractors • Third party licensed traffic expert

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
				• USEPA's 40 CFR Part 1039 (Nonroad Engine Regulations) and 40 CFR Part 86 (Heavy Duty Vehicle Regulations)				
26.	Noise and vibration	Train operation noise	• Noise Barriers: To reduce train operation noise, barriers will be installed near homes within 100m of the railway at Kazybek Bek (1km) and Zhetygen (2.25km). • Equipment Selection: To meet GOST 12.1.003-83 standards, workplace noise should not exceed 85dB. Equipment should be selected to emit less than 85dB and sound barriers may be used if needed.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways WHO Guidelines for Community Noise • USFTA Transit Noise and Vibration Impact Assessment Manual • ISO 14001:2015 - Environmental management system	• Records and reports •	• Occupational Health and Safety Plan (OHSP)	• N/A	• KTZ • Operation contractors
27.	Surface water quality	Railway operation on surface water quality	• The following are recommended GIIP: • Permanent wastewater treatment facilities will be established for all stations and locations where employees will regularly work and with sufficient capacity for other rail users. The wastewater treatment facilities should be designed and operated to meet the Project Discharge Standards for Treated Sanitary Sewage. • All runoff water from the locomotive and fuel depots at Zhetygen Park B Station will be collected in appropriate drainage structures for oil separation and sedimentation to meet the Project discharge standards for stormwater. • Storm water generated from depot sites, roof areas and outdoor paved floor areas will be treated through the collection and drainage system with settling pits for the treatment of suspended solids, garbage, mud etc. which could be swept along with runoff, before being discharged into the environment. • As part of the Operations and Maintenance Plan (O&M Plan), oils, fuels and chemicals should only be used and stored in designated areas which have pollution prevention facilities. All fuel tanks and storage areas should be provided with locks and be sited on sealed areas, 110% of the capacity of the largest tank or 25% of the total capacity of all the tanks within the bund whichever is the greater. The bund should be drained of rainwater after a rain event. The O&M Plan is further detailed in the ESMP. • Fixed fuel storage infrastructure should be on flat, impermeable surface and surrounded by a bund with a volume of 110% of the volume of the storage tank(s), and fuel transfer at fixed stations should be performed on a concrete surface draining to a mechanical oil separator.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways	• Site inspections • Records and reports	• Occupational Health and Safety Plan (OHSP) • Stormwater and Erosion Control Plan • Water quality management plan	• Operation and Maintenance (O&M) Plan	• KTZ • Poligram • Operation contractors

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
			• Proper guidelines and procedures should be developed for immediate clean-up actions following any spillages of oil, fuel or chemicals. • All drainage structures and sediment and erosion control measures will be inspected and maintained on a regular basis, including clearance of channels or silt traps during the wet season. • Herbicide chemicals will be selected in accordance with IFC EHS Guidelines for railways, and trackside maintenance staff will be trained in the safe application of herbicides, including controls on their use in the vicinity of surface water bodies as described in Section 1.1.1 of the IFC EHS Guidelines for Railways. This will include their safe handling, storage and transport, weather restrictions on use, and maintaining appropriate buffer zones adjacent to water bodies during application.					

28.	Biodiversity	Wildlife Mortality Risks Associated with Railway Infrastructure	• Establish vegetation buffers near river crossings to enhance habitat connectivity for avian and small mammal species. There should be some focus on river and stream beds so that in addition to facilitating habitat connectivity, the loss of 0.139 km^2 of loss of natural habitat is also addressed. More details for implementing this action and monitoring towards no net loss of provided in the BMP.
			• Maintain underpasses and culverts free of debris to ensure their continued use by wildlife.
			• Develop a wildlife monitoring plan for target species like herpetofauna, medium sized mammals and raptor and ground dwelling avifauna.
			  ○ After the beginning of the railway operations, and to get a good evaluation of mortality estimates, monitoring should cover a minimum period of three (3) years.
			  ○ Prioritise surveys during peak activity periods, such as dispersal, migration, and breeding seasons, ensuring temporal alignment with species-specific activity cycles. For example: for Central Asian Tortoise schedule surveys during active months (April-May) to capture data on movement and collisions, avoiding inactive periods (winter hibernation and summer aestivation).
			  ○ Implement systematic mortality surveys along railway tracks, recording carcass locations, species, and suspected causes of death.
			  ○ Use transect-based observations to detect live animals and their behaviours near railway infrastructure.
				• WBG Environmental, Health, and Safety (EHS) Guidelines
				• IFC Environmental, Health, and Safety Guidelines for Railways
				• IFC Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resource
				• Convention on the Conservation of Migratory Species of Wild Animals (CMS)
				• Central Asian Mammals Initiative (CAMI)
					• Site inspections
					• Records and reports
						• Biodiversity Management Plan (BMP)	• N/A	• KTZ
								• Operation contractors

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
			○ Train railway staff and local communities to report wildlife incidents, creating an incident reporting protocol for timely response and analysis. ○ Based on monitoring results, the mitigation plan should be updated regularly to address emerging risks, ensure the effectiveness of measures, and refine the approach according to species-specific needs. • Based on construction and operation monitoring data if there are any high-risk sections implement physical barriers such as wildlife fencing along those sections of the railway to reduce direct collisions, particularly for small mammals, reptiles, and birds. • Install clear signage along the railway to raise awareness among train operators regarding wildlife presence and potential collision risks. This can help enhance vigilance during critical periods when wildlife activity is high. • Provide training for all relevant railway personnel on wildlife risk awareness, collision reporting, and how to handle wildlife sightings or accidents. • In areas with high wildlife activity, consider adding wildlife friendly low-level lighting to tracks, especially near wildlife crossing points. This may enhance the visibility of animals at night and reduce collision risks, particularly for nocturnal species.					
29.	Biodiversity	Habitat fragmentation, degradation and wildlife barrier	• In addition to the mitigation measures recommended previously, the following mitigation measures are recommended: • Restoring and enhancing the habitat on both sides of the railway line. The restoration should prioritise native vegetation species. • An Integrated Vegetation Management Plan (IVMP) should be developed for the plantation along the railway corridor, which will require ongoing maintenance and further management during the operational phase. The plan should include the following components: ○ Replanting & Maintenance: If planted seedlings fail to establish, they should be replanted within the first planting cycle. Maintenance and protection should continue for a three-year period to support the growth and survival of the new plantings. ○ Monitoring & Reporting: Biannual monitoring should be carried out to assess plant survival rates and overall health. Monitoring should focus on key indicators such as leaf discoloration, pest damage, defoliation, and	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resource • Convention on the Conservation of Migratory Species of Wild Animals (CMS) • Central Asian Mammals Initiative (CAMI)	• Site inspections • Records and reports	• Biodiversity Management Plan (BMP)	• N/A	• KTZ • Operation contractors

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
			growth anomalies. A survival benchmark, such as an 80% survival rate, should be set for the monitoring period. Reports should be submitted to the relevant authorities. o Health Assessments: A standardized health assessment process should be used, where plants are rated on a scale of healthy, moderate stress, and severe stress. This will allow for early detection of potential issues, such as nutrient deficiencies or environmental stressors. o Invasive Species & Pest Management: The IVMP should include specific measures for identifying and controlling invasive plant species and managing pest infestations that may threaten the newly planted vegetation. Non-chemical methods should be prioritised for pest and weed control. o Responsibility & Coordination: The responsibility for monitoring and maintaining the plantation should be clearly assigned to the O&M contractors, working in close collaboration with the hired ecologist to ensure the long-term success of the vegetation. o Replacement Plan: If plantings do not survive, a replacement strategy should be developed in consultation with the relevant regulatory authorities. Replacement should occur in the first planting season to ensure continuous coverage and ecological restoration. • Implement control measures for invasive plant species that may be exacerbated by railway maintenance and disturbed soils. • Identify offset locations and develop an offset management plan to compensate for the riparian natural habitat that has been converted. • Periodic reviews of habitat restoration success and wildlife passage effectiveness, adjusting strategies as necessary. • Based on monitoring data (see guidance for wildlife monitoring plan discussed previously) install soundproofing barriers or dense plant cover along sensitive stretches of the railway corridor to absorb sound. • Prohibit the dumping of all types of waste along the corridor or surrounding areas. Wastes should be segregated by type (e.g., organic, hazardous, recyclable) and transported to designated facilities in nearby townships or cities for safe and responsible disposal. • Enforce a ban on any activities leading to soil or water contamination, including open burning of any					

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
			type of waste. Proper waste management systems should be implemented to avoid environmental degradation. • Prohibit the discharge of any solid or liquid wastes, including wastewater, oils, and cleaning residues, into rivers, streams, or other water bodies. This includes effluents from washing vehicles, equipment, and machinery. • Implement strategies to limit the use of anti-icing reagents, ensuring that only minimal amounts are applied and that they are properly contained to prevent runoff. Using less toxic de-icing materials such as calcium chloride, phosphate inhibited or calcium magnesium acetate, which do not cause irreversible changes in photosynthesis and subsequent destruction of tissues of plants and animal deaths. Additionally, installation of drainage systems to capture runoff and prevent soil salinisation.					
30.	Biodiversity	Collison and Electrocution Risks from Transmission Line	• Bird Diverter Installation: Install bird flight diverters on overhead transmission lines, especially along the PS-Alma-500 and Zhana Arna 1.9 km OHTL. Also explore the possibility of installing bird divertors on existing TLs that will be relocated, especially near any waterbodies. These devices should be large and placed 5-10m apart to enhance visibility and reduce collision risks. The installation of these diverters should follow guidelines set by the relevant local authorities. • Insulation and Perch Management for Transmission Lines: • Poles with suspended insulators should maintain a distance of at least 60cm between a likely perch (cross-arm) to the energized parts (conductors). In instances where the conductors run above or too close to the cross-arm, tubing should be used. Insulating chains of at least 152cm in length (determined based on the average wingspan of common avifauna) should be used for bird-safe strain poles. • Perch management: Cross-arms, insulators and other parts of the power lines can be constructed so that there is no space for birds to perch where they can be close to energized wires. This is often done by using exclusion devices, or perch deterrents. If cross arms are fitted with deterrents but pole-tops and insulators remain exposed, perching is likely to continue unabated. • Carcass Monitoring and Reporting:	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resource • Convention on the Conservation of Migratory Species of Wild Animals (CMS) • Central Asian Mammals Initiative (CAMI)	• Site inspections • Records and reports	• Biodiversity Management Plan (BMP)	• N/A	• KTZ • Operation contractors

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
			• Carcass Surveys: Implement regular monitoring along the TLs and railway corridor to detect carcasses. The O&M team should be trained to recognize carcasses and report them immediately to the EHS manager. High occurrences of carcasses should trigger an immediate review of potential mitigation measures to ensure the reduction of collision and electrocution risks. • Carcass Disposal Protocols: Develop clear protocols for the immediate removal and safe disposal of carcasses found near transmission lines or infrastructure. This will help prevent scavenger species from being attracted to high risks areas and reduce the likelihood of collision and electrocution risks. • Ongoing Monitoring: Conduct long-term monitoring of raptor populations in collaboration with wildlife department to assess the effectiveness of mitigation measures. Data should be shared with local authorities to track trends in bird mortality and refine management strategies, if required.					
31.	Social	Labour and Working Conditions	• Align the Project's operational health and safety plan with measures outlined in the Occupational Health and Safety Management Plan documented in the Environmental Social management System. The key measures include: • Hazard Control: ◦ Use of PPE, proper lighting, site demarcation, and lifting plans for heavy equipment. • Workplace Safety: ◦ Manual handling training to prevent injuries. ◦ Fall protection for work at heights. ◦ Safe excavation practices to avoid utility damage. • Permit-to-Work (PTW): ◦ Controls hazardous activities (e.g., hot work, electrical work, confined spaces). • Emergency Preparedness: ◦ Monthly mock drills, fire safety checks, and emergency procedure displays. • Vehicle and Equipment Safety: ◦ Regular maintenance, speed control, seatbelt use, and fire extinguishers in vehicles. • Occupational Health and Safety Training: ◦ Worker inductions, daily toolbox talks, and task-specific safety training (e.g., welding, electrical work). • Worker Wellbeing: ◦ Rest shelters, drinking water, and heat stress precautions.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC PS2 Labour and Working Conditions	• Site inspection • Reports if applicable • Training records •	• Stakeholder Engagement Plan (SEP) and Grievance Redress Mechanism (GRM) • Contractor Management Procedure (CMP) • Occupational Health and Safety Plan (OHSP)	• N/A	• KTZ for SEP-GRM • KTZ and EPC Contractor Integra and Poligram for CMP and OHSMP.

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties

			• Monitoring:
			  ◦ Regular OHS inspections, weekly/monthly safety meetings, and reporting of incidents.
			• Code of Conduct for GBVH
			  ◦ Establish clear codes of conduct for workers (for both operation and construction phases) with zero-tolerance policies for GBV, harassment, and exploitation. Communicate and cascade policies down to contractors and subcontractors.					

32.	Social	Community Health and Safety	• The EHS Guidelines suggest the following strategies to address this issue: • Capacity Building: Investing in the expansion and enhancement of local healthcare and emergency services to accommodate the increased demand. • Emergency Response Planning: Developing and implementing comprehensive emergency response plans that include coordination between railway operators and local emergency services. • Community Engagement: Involving local communities in planning processes to ensure that their needs and concerns are addressed, and to foster collaboration in mitigating potential impacts. • Beyond the immediate risks, the EHS Guidelines for Railways highlight other community health and safety aspects that should be considered: • Noise and Vibration • Continuous railway operations can generate noise and vibrations that may affect nearby residents. Mitigation measures, such as installing noise barriers and scheduling train operations to minimise nighttime disturbances, can help reduce these impacts. • Hazardous Materials Transport • If the railway is used to transport hazardous materials, there is a potential risk of spills or accidents that could harm the community. Strict adherence to safety protocols and regular training for personnel can mitigate these risks.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC PS4 Community Health, Safety, and Security	• Site inspection • Reports if applicable • Grievance Records • Community stakeholder engagement reports	• Stakeholder Engagement Plan (SEP) and Grievance Redress Mechanism (GRM) • Occupational Health and Safety Plan (OHSP) •	• SEP-GRM Monitoring Reports	• KTZ for SEP-GRM • KTZ and EPC Contractor Integra and Poligram for CMP and OHSMP.
33.	Social	Gendered impacts on women, including risks of gender-based violence	• Provide targeted livelihood restoration programs for women in alignment with the guidance set out in the Livelihood Restoration Plan. This may include financial literacy training, access to microloans, and skill development workshops. • Ensure that vulnerable groups which are disproportionately impacted such as women-headed households receive tailored assistance such as additional financial aid or entrepreneurial support for sustainable livelihoods, or as set out in the Livelihood Restoration Plan.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC PS2 Labour and Working Conditions • IFC PS4 Community Health, Safety, and Security	• Site inspection • Reports if applicable • Grievance Records • Community stakeholder engagement reports	• Stakeholder Engagement Plan (SEP) and Grievance Redress Mechanism (GRM) • Contractor Management Procedure (CMP) • Occupational Health and Safety Plan (OHSP) •	• SEP-GRM Monitoring Reports	• KTZ for SEP-GRM • KTZ and EPC Contractor Integra and Poligram for CMP and OHSMP.

No.	Aspect	Impact / Activity	Mitigation measures description	Relevant Guidelines / Source of GIIP	Verification Means	Related Management Plans	Related Monitoring Plans	Responsible parties
			• Establish clear codes of conduct for workers (for both operation and construction phases) with zero-tolerance policies for GBV, harassment, and exploitation. Communicate and cascade policies down to contractors and subcontractors. • Establish specific hiring quotas or outreach programs to encourage women to apply for operational roles, particularly in non-traditional sectors such as engineering and operations. • Ensure the GRM is gender-sensitive and accessible, with provisions for confidential reporting and resolution of gender-specific grievances. • Provide well-lit and safe pedestrian crossings, particularly in areas frequently used by women and children. Further consultations with women and local authorities may be required to identify these areas.					
34.	Cultural heritage (CH)	Promotion of Cultural Heritage during Operation Phase	A catalogue of archaeological assets discovered during the project and delivered to the museums should be prepared, promoted and published. If no other archaeological assets are discovered, the promotion of the existing cultural heritage site should still be conducted via the public media, and in the relevant Akimats made available to the public.	• WBG Environmental, Health, and Safety (EHS) Guidelines • IFC Environmental, Health, and Safety Guidelines for Railways • IFC PS8 Cultural Heritage • National CH laws, refer to the CHMF.	• Records and reports	• Cultural Heritage Management Framework (CHMF)	• N/A	• KTZ and EPC Contractor Integra

9.4.2.3 THEMATIC MANAGEMENT AND MONITORING PLANS

The management plans mentioned above are summarised and presented in **Table 9-5.** It is essential for the successful implementation of the mitigation and management measures committed by the Project owner during both the construction and operational phases. It is the responsibility of the Project owner to designate the appropriate parties to implement each plan.

Construction Environmental and Social Management System (CESMS) summarises the environmental and social management plans for construction phase.

TABLE 9-5: SUMMARY OF MANAGEMENT AND MONITORING PLANS

No.	Category	Management Plans	Related mitigation No. as in Table 9-3 and Table 9-4	Phase	Monitoring	Implementation	Current Status
1.	Air Quality	• **Pollution Prevention Plan - Air Emissions Management Plan** that includes the following: • Assessment on air quality during construction phase. • Embedded controls and mitigations listed in **Section 9.4.2.1** and **9.4.2.2**. • Guidelines on additional dust control measures based on GIIP. • Equipment and vehicle management • Construction and operation air quality monitoring and reporting	1, 2, 25	Construction and operation phase	For construction phase, • **Daily** visually inspect for airborne dust and dry areas within construction site and along the transport roads. • **Quarterly** air quality monitoring at nearest ASR locations from construction activities at Kazybek Bek and Zhetygen stations. • Parameters to include PM10, PM2.5 For operation phase, • **Quarterly** air quality monitoring at nearest ASR locations from train stations at Kazybek Bek and Zhetygen. • Parameters to include PM10, PM2.5	• For construction phase, prepared and implemented by EPC and supervised by KTZ. • For operation phase, prepared, implemented and supervised by KTZ.	To be prepared upon Supplementary ESIA disclosure.
2.	Noise	• **Pollution Prevention Plan – Noise and Vibration Management Plan** that includes the following: • Assessment of noise impact. • Embedded controls and mitigations listed in **Section 9.4.2.1** and **9.4.2.2**. • Guidelines on additional noise control measures based on GIIP. • Equipment and machinery management • Construction noise monitoring and reporting • Mitigation strategies for sensitive times • Train Scheduling and Speed Restrictions • Equipment and machinery maintenance • Contingency plans for handling unexpected noise spikes or complaints during construction and operation.	3, 4, 26	Construction and operation phase	**Quarterly** construction noise measurement: • Minimum 1-hour measurement at daytime and nighttime. • At nearest NSR locations from construction activities (especially during blasting activities) at Kazybek Bek and Zhetygen stations. • Parameters to include $L_{Aeq(1hr)}$ and L_{max}. • • **Complaint-focused** noise monitoring: • If any noise complaints are received, the noise levels at the affected receptor should be monitored and evaluated.	• Prepared and implemented by EPC. • Supervised by KTZ.	To be prepared upon Supplementary ESIA disclosure.
3.	Surface Water, Soil and Groundwater	The following two management plans are recommended for GIIP: **Stormwater and Erosion Control Plan** that includes the following: • Guidelines on working in/near water. • Erosion and stormwater control measures such as the implementation of silt fences, sediment traps, or barriers around exposed soil areas and stockpiles to prevent sediment runoff into nearby water bodies. • Outlines routine inspections and monitoring procedures, including regular culvert checks and regular cleaning (minimum quarterly). • Ensure regular cleaning of drainage systems, culverts, and embankments to prevent blockages and adequate water flow. •	5, 6, 27	Construction phase	**Weekly** monitoring: • At locations where construction works should be established for a period of several months (e.g. at bridge crossings and temporary construction roads that cross rivers with drainage pipes installed) or at important social or environmental receptor locations identified downstream • Parameters to include dissolved oxygen, Total Suspended Solids (TSS), turbidity and pH. • Water quality data obtained from the monitoring programme should be compared from upstream and downstream sampling locations.	• Prepared and implemented by EPC. • Supervised by KTZ.	To be prepared upon Supplementary ESIA disclosure.

No.	Category	Management Plans	Related mitigation No. as in Table 9-3 and Table 9-4	Phase	Monitoring	Implementation	Current Status
		• Water Quality Management **Plan** that includes the following: • Surface water protection controls and construction best practices. • Wastewater management, whether the wastewater is going to be treated on-site or transport to a third party. • Implementing a surface water quality monitoring programme in compliance with regulatory requirements and best practices during construction works. • Implementing corrective actions if monitoring results indicate elevated sediment levels, such as reinforcing sediment control barriers or adjusting site management practices.					
4.	Biodiversity	**Biodiversity Management Plan (BMP)** • Outlines the mitigation and monitoring measures to be implemented throughout the Project lifecycle within the project area for biodiversity impacts identified through the ESIA.	7-13, 28-30	Construction and operation phase	• Excavations shall be inspected **daily** for trapped animals. • Quarterly monitoring shall be conducted to assess the overall effectiveness of the fencing and adjust mitigation measures as needed based on observed wildlife interactions with the structure. • Regular carcass monitoring and disposal protocols should be established, with trained personnel reporting findings. • Ongoing raptor population monitoring should be conducted to evaluate the effectiveness of these measures and adjust as needed.	• BMP is prepared by ERM. • For construction phase, implemented by EPC and supervised by KTZ. • For operation phase, implemented by O&M contractors and supervised by KTZ.	Drafted by ERM.
5.	Social	**Stakeholder Engagement Plan (SEP) and Grievance Redress Mechanism (GRM)** • Outlines the process that will be followed in order to listen to, collaborate with, or inform stakeholders about project activities. • Development of the SEP involves identifying, mapping and prioritising stakeholders to determine the best tactics for effective engagement. • Grievance mechanism is a framework to address complaints and resolve grievances in a timely, effectively and culturally appropriate manner.	14-20, 31-33	Pre-construction, construction, operation phase	Impacts on local settlements along the alignment Seasonal or six monthly-monitoring of the adequacy of cattle passes provided by the Project in the construction and operational phase.	• SEP & GRM are prepared by ERM and implemented by KTZ and all contractors.	Drafted by ERM.
6.	Social	**Livelihood Restoration Plan (LRP)/ Resettlement Framework (RF)** • Ensures that affected individuals and communities are compensated fairly and supported in rebuilding their lives, with the ultimate goal of restoring or improving their living standards and livelihoods.	14-20, 32-33	Pre-construction, construction, operation phase	• Preparation of the **Land Acquisition Compensation Status Report** by KTZ, and updates to the report. • Internal monitoring by LRP Implementation Team. • The performance objectives to be monitored: ◦ Disbursement of compensation payment ◦ Disbursement of allowances	• LRP & RF are prepared by ERM and implemented by KTZ and all contractors.	Drafted by ERM.

No.	Category	Management Plans	Related mitigation No. as in Table 9-3 and Table 9-4	Phase	Monitoring	Implementation	Current Status
		• Ensures transaction costs incurred of buying alternate land and deduction of depreciation costs incurred from assets on land during land acquisition are reimbursed to align with IFC PS5 full replacement cost. • Provides livelihood restoration options and entitlements for those economically and physically displaced mitigate their impacts and restore their livelihoods pre-Project level. • Ensures that Project affected parties have a non-discriminatory channel to raise grievances, and a responsible person from KTZ to whom Project affected persons can raise their grievances. • Ensures regular community engagement and disclosure of eligibility and entitlements.			◦ Restoration of livelihoods ◦ Meaningful consultation and Grievance redressal ◦ Budget and Time Frame ◦ Institutional arrangement ◦ Employment and capability building ◦ Vulnerable groups support ◦ Women led support • External monitoring by independent third-party agency, distinct from LRP Executive Agency. • External monitoring program will consist of an interim audit and a completion audit. • The interim audit will focus on the following areas: ◦ General Implementation ◦ Livelihood Restoration ◦ Monitoring and Evaluation ◦ Vulnerable Groups ◦ Grievance Management • The completion audit will focus on the following areas: ◦ Evaluating the effectiveness of measures taken to prevent and mitigate displacement impacts by comparing actual Project outcomes to those predicted in the LRP. ◦ Verifying that all entitlements and commitments outlined in the LRP have been fulfilled. ◦ Assessing whether LRP measures have been successful in restoring or enhancing the living standards and livelihoods of affected individual. ◦ Reviewing any unresolved systemic grievance. • Identifying corrective actions necessary to fulfil LRP commitments, if any remain incomplete or as gaps.		
7.	Social – Cultural Heritage	**Cultural Heritage Management Framework (CHMF)** including: **Cultural Heritage Screening Checklist** • A practical tool designed to assist KTZ in meeting their regulatory requirements and any funding body conditions through identification and assessment of potential impacts on cultural heritage early in the project planning process. **Chance Find Procedure** • A procedure to inform users how to manage cultural heritage that is unexpectedly discovered during project construction. **Kurgan Archaeological Landscape Mitigation and Management Guideline**	20-24, 34	Construction and operation phase	N/A	• Prepared by ERM, implemented by KTZ and all contractors.	Drafted by ERM.

No.	Category	Management Plans	Related mitigation No. as in Table 9-3 and Table 9-4	Phase	Monitoring	Implementation	Current Status
		• Serves as a framework to protect, manage, and mitigate potential impacts on culturally significant sites and features associated with the project. The plan aims to balance development needs with the preservation of heritage resources, ensuring compliance with local and international heritage protection standards.					
8.	Social – Labour and Working Conditions	**Contractor Management Procedure (CMP)** Ensures that contractors and workers comply with health and safety laws and organisational policies. It includes guidelines for contractor selection, induction training, monitoring/supervision, and performance evaluation.	15, 20, 31, 33	Construction and operation phase	N/A	• For construction phase, prepared and implemented by EPC and supervised by KTZ. • For operation phase, prepared, implemented and supervised by KTZ.	To be prepared upon Supplementary ESIA disclosure.
9.	Social - Health & Safety	**Occupational Health and Safety Plan (OHSP)** • Document ensures the management of health and safety for employees, the public, and the environment. • Addresses physical and chemical hazards on the project site and includes guidelines for personal protection and safe operations for employees and subcontractors. • Addresses environmental nuisances arise from construction and Project activities including dust, air quality, noise, vibration, solid waste / wastewater management, site contamination etc.	1-6, 20, 26-28, 31-33	Construction and operation phase	Refer to No. 1 to 3 above.	• For construction phase, prepared and implemented by EPC and supervised by KTZ. • For operation phase, prepared, implemented and supervised by KTZ.	To be prepared upon Supplementary ESIA disclosure.
10.	Social - Health & Safety	**Operations & Maintenance Plan (O&M)** • A comprehensive O&M plan ensures railway operations run smoothly while minimising downtime and maximising safety. • The plan includes the train operations plan which states any service planning, employee management, operation control and monitoring. • Includes infrastructure maintenance plan which sets the requirements of routine maintenance. • Implement speed restrictions and scheduling adjustments to minimise rail expansion effects.	26-34	Prior commencement, Operation phase	N/A	• Prepared, implemented and supervised by KTZ.	To be prepared prior commencement of operation.
11.	Unplanned Events	**Emergency Preparedness and Response Plan (EPRP)** • The plan is essential for preparing for, responding to, and recovering from natural disasters or catastrophes. • Involves risk assessment, mitigation strategies, disaster planning, and community education to	Refer to **Section 6.9**.	Prior commencement, Operation phase	N/A	• Prepared, implemented and supervised by KTZ.	To be prepared upon Supplementary ESIA disclosure.

No.	Category	Management Plans	Related mitigation No. as in Table 9-3 and Table 9-4	Phase	Monitoring	Implementation	Current Status
		ensure safety by minimising damage and exposure to hazards. • Additionally, a fire prevention plan should identify major fire hazards, necessary fire protection equipment, and responsible individuals. • The contingency Plan and Disaster Management Plan will also be covered under the overall EPRP. • Includes mitigation for climate risks mitigations. • ERP to address heat-related track deformation, including rapid deployment of maintenance teams. • Stay updated about the weather forecast and river levels to anticipate potential risks. • Ensure regular cleaning of drainage systems, culverts, and embankments to prevent blockages and adequate water flow. • Deploy rapid response teams for track inspections and maintenance immediately after flooding events. • Implement resilient communication systems to ensure real-time coordination between railway operators and emergency services.					
12.	Unplanned Events	**Traffic Management Plan (TMP)** • Outlines measures to ensure the safety of road workers and users during construction. • It includes details on work hours, project specifics, management systems, work phases, required signage, speed limits, road levels, site access and egress, and communication and emergency procedures. • Develop protocols regarding speed reduction in extreme cold conditions to prevent derailments caused by brittle tracks or reduced braking efficiency.	25	Construction and operation phase	**Traffic Flow Monitoring**: KTZ to undertake vehicle counts around the stations during the start of the operations phase and undertake a screening exercise once this survey data is known.	• Prepared, implemented and supervised by KTZ.	To be prepared upon Supplementary ESIA disclosure.

9.5 PROPOSED IMPLEMENTATION ARRANGEMENTS

9.5.1 OVERARCHING ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM (ESMS)

KTZ will put in place an overarching E&S Management System (ESMS) in order to implement the Management Programs that have emerged as an outcome of the Supplementary ESIA. The ESMS will incorporate the following elements: (i) policy; (ii) construction ESMS (CESMS); (iii) operations ESMS and additional implementation arrangements. The ESMS will be developed and applied in accordance with the reference framework outlined in **Section 3** Applicable Reference Frameworks. The ESMS is to be contractually enforced throughout the construction and operations phase, and is applicable to all contractors (including operations and maintenance contractors, if any). These contractors must adhere to all ESMS requirements, including relevant sub-plans and procedures relating to their scope of work.

9.5.1.1 POLICY

KTZ shall comply with the applicable local laws and regulations and applicable international standards, together with the company specific policies and guidelines. Where both local and international standards exist, the most stringent standards shall be applied. Refer to Section 3 Applicable Frameworks in CESMS.

KTZ will establish and enforce a project specific policy in the areas of health and safety (H&S Policy), Environmental Protection Policy (EP Policy), and social responsibility (Social Policy), which are collectively referred to as the HSES Policies. These policies will serve as a public commitment for environmental and social management and will be aligned to existing KTZ corporate-level policies[345]. The responsible personnel within the organisation for ensuring compliance and execution will be identified to sign off on these policies. To ensure these policies are understood and accepted at all levels of the Project, all Project Personnel and Visitors will be introduced to the policies during their Induction Training. The policy statements will be prominently displayed on announcement boards at the Project Sites and Facilities for easy access.

9.5.1.2 CONSTRUCTION ESMS (CESMS)

As the construction is underway, the Supplementary ESIA has included a CESMS, which brings together key elements across the management programs as well as the applicable reference framework for implementation ahead of peak construction and project commissioning.

The CESMS will be implemented to achieve/facilitate the following:

- Identify the E&S impacts from the construction phase, and assess the corresponding risks associated with these impacts.
- Develop measurements to predict and avoid impacts of the construction phase on surrounding communities, employees, and the environment.
- Minimise any unavoidable impacts and compensate for residual impacts to manage the risks from the construction phase.
- Effectively use the CESMS to review and improve the overall E&S management performance and to achieve sustainable development.

[345] Multilateral Investment Guarantee Agency. (n.d.). *KTZ railway project*. Retrieved from https://www.miga.org/project/ktz-railway-project-0

- Ensuring all relevant E&S information are disclosed and disseminated in accordance with requirements.
- Receiving and managing community complaints to achieve harmonious coexistence with the surrounding communities during the construction phase.

Its implementation will be overseen by the Developers Managing Director for Construction of NC KTZ JSC with the support of the Environmental, Health and Safety (EHS) Officer. The CESMS is a live document, and all E&S policies and management programs identified in this manual will be updated periodically to respond to any changes in the Project's activities, regulatory requirements, local conditions and outcomes of the stakeholder engagements. This CESMS manual will be reviewed periodically throughout the construction phase to ensure continuous improvement and alignment with GIIP.

The sections and minimum standards that are applicable to CESMS include:

1. Introduction: Purpose and scope of CESMS.
2. Overview: Project description, key environmental E&S risks and mitigation measures.
3. Applicable Reference Framework:
    - Environmental and Social Policy aligned with international and national standards.
    - Commitment to continuous improvement and compliance with legal and lender requirements.
4. Roles and Responsibilities for effective ESMS Implementation: Defined roles and responsibilities for environmental and social management.
5. Implementation of Environmental and Social management procedures.
    - This section outlines the practical steps necessary to apply the ESMP during the construction phase.
    - It provides in detail the environment, health and safety, and social procedures to be implemented during construction phase.
6. Monitoring and Reporting Mechanism: Describes reporting, monitoring and audits requirements.
7. Training and Capacity Building: Training is needed for the effective implementation of the ESMP. This section lists out the mandatory training requirements and on the thematic management plans of the CESMS.

9.5.1.3 OPERATIONS ESMS (OESMS)

The OESMS and associated Operational Management Plans should be developed by KTZ at least 6 months prior to commissioning and operations. Specific E&S commitments identified as part of the operations phase for each environmental and social impact will form the base of developing the OESMS.

The OESMS will include mechanisms for regular review and updates to incorporate emerging risks and improve E&S performance over time. Comprehensive safety measures will be included to ensure not only the regulations but also the protection of workers and communities. It is understood that KTZ will put in place a formal railway management system which is expected to include a dedicated set of procedures and processes for operational railway safety, emergency preparedness and response as well as ongoing stakeholder engagement.

The sections and minimum standards that are applicable to OESMS refer to the list for CESMS in **Section 9.5.1.2**.

9.5.2 PROPOSED ORGANISATIONAL STRUCTURE FOR ESMP IMPLEMENTATION

KTZ will incorporate a formal organisational structure under the Astana leadership team and the Almaty Project Manager to implement the ESMP in collaboration with the EPC Integra, Poligram and any other subcontractors (for the construction phase). KTZ Almaty's current technical and engineering team capacities will be enhanced by identifying and engaging qualified personnel based on the suggested structure.

KTZ will be responsible for complying with and implementing the ESMP, monitoring the contractor's E&S performance, engaging with affected communities, managing the grievance program, amongst other E&S responsibilities. KTZ will need to implement robust compliance monitoring with adaptive management.

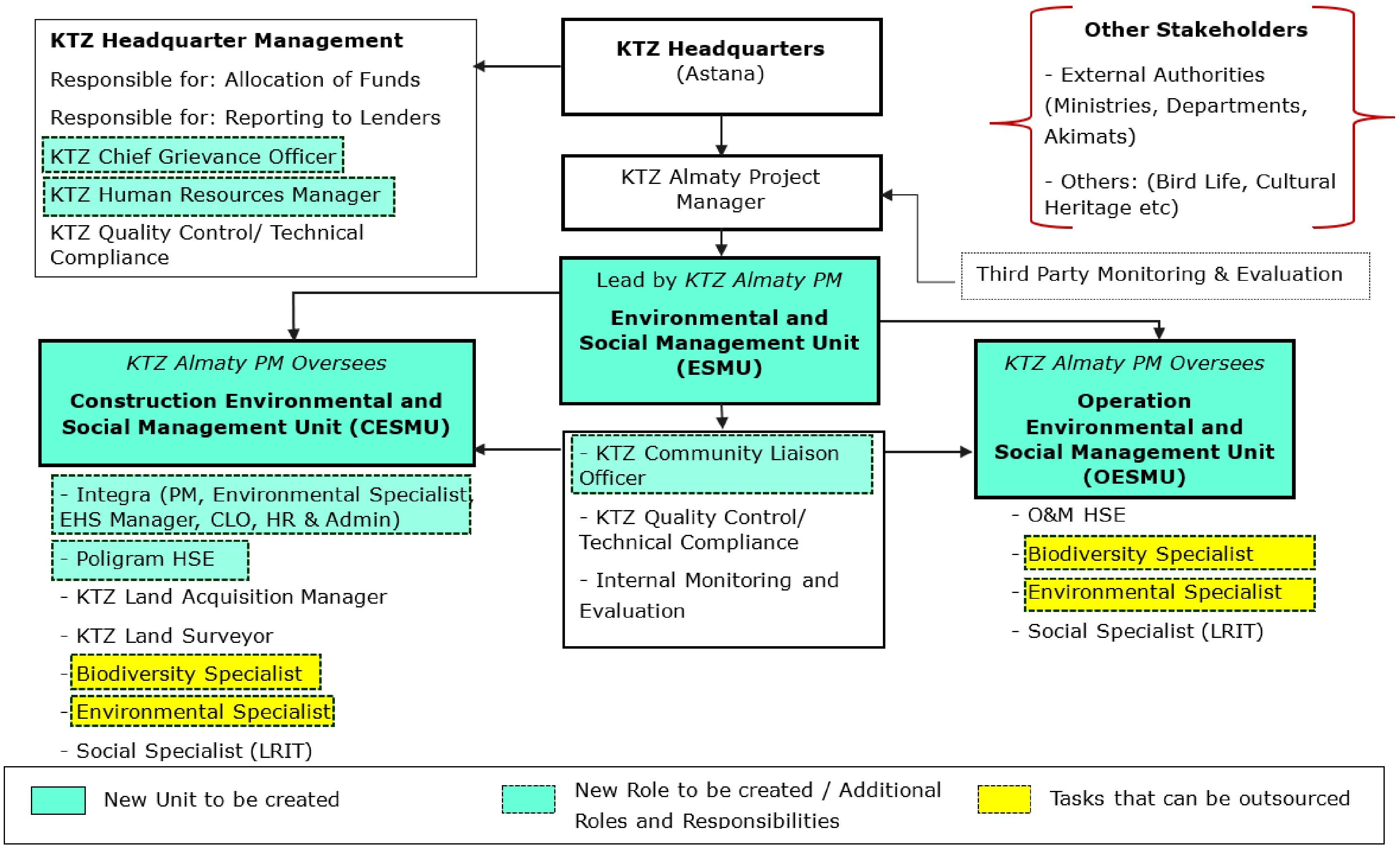
- The implementation of the ESMP will be stewarded by KTZ, through the proposed set up of a new unit, the Environmental and Social Management Unit (ESMU), and will be tracked by an external third party.

The following figure below shows the organisational framework for the ESMP implementation. The implementation management structure will involve two levels of management. These are:

- KTZ Corporate team in Astana (which will be accountable for the ESMP implementation)
- Environmental and Social Management Unit (ESMU) – Proposed new unit to be established at KTZ Almaty level (which will be responsible for the ESMP implementation). The ESMU structure has been shown separately for the construction and operations phase through the Construction Environmental and Social Management Unit (CESMU) and the Operation Environmental and Social Management Unit (OESMU). However, in practice, it is understood that the CESMU will be restructured at the time of the commissioning of the railway line to take on E&S management during the operations phase.

The implementation of the ESMP requires the successful collaboration with Government stakeholders, through the District and Regional Akimats, as well as other external stakeholders, such as Bird Life and Cultural Heritage experts. **Figure 9-1** illustrates the organisational framework for ESMP.

FIGURE 9-1: ESMP ORGANISATIONAL FRAMEWORK



9.5.2.1 KTZ HEADQUARTERS

KTZ Astana

KTZ will oversee the overall, high-level implementation of the ESMP, through the KTZ Almaty PM. The KTZ Headquarters will include a management team which is responsible for managing the funds allocated for the Project, and for the regular reporting to Lenders. Furthermore, there will be a proposed KTZ Chief Grievance Officer to manage grievances, and a proposed *KTZ Human Resources (HR) Manager* and HR related matters at a corporate level. The KTZ Headquarter Management team will also have a *KTZ Quality Control / Technical Compliance staff* who is the responsible *Corporate E&S Compliance Manager,* who is tasked with ensuring all construction activities comply with environmental laws, regulation and permits, and for the successful implementation of the ESMP. The *KTZ Quality Control / Technical Compliance Manager* also sits within the ESMU.

The roles and responsibilities of KTZ Headquarters include:

- Ensure alignment among all stakeholders, including KTZ, Government representatives including Almaty Akimat Oblast level and District Akimat level, Almaty Regional Land Committee, contractors and other relevant stakeholders.
- KTZ will need to ensure that the ESMP E&S requirements are adequately reflected in the project bidding documents, ensure all the administrative approvals are in place for all the plans and documents on related E&S aspects, and prepsare quarterly reports on E&S performance of the Project. KTZ, as the owner of the Project, at Headquarters level, will provide ongoing support to ESMU at site level, including the support to the KTZ Project Manager (site level) and the *KTZ Supervision Engineer* during the Project construction.

KTZ Almaty

- The ESMP will be implemented by the ESMU which is headed by the *KTZ Almaty Project Manager (PM)*, who is responsible for the management of the overall implementation of the ESMP.

9.5.2.2 ENVIRONMENTAL AND SOCIAL MANAGEMENT UNIT (ESMU)

The ESMU, headed by the *KTZ Almaty PM*, will oversee the implementation the ESMP and Collaborates directly with the designated implementation agencies to put the ESMP into action. Core members of the ESMU consist of the *KTZ Community Liaison Officer (CLO)*, the *KTZ Quality Control / Technical Compliance Manager* and regular internal monitoring and evaluation. These core members are involved throughout the construction and operation phase. The ESMU will coordinate the activities of all stakeholders on the ground and oversee E&S initiates. The *Construction ESMU (CESMU)* is expected to be established within one (1) month of the disclosure of the Supplementary ESIA, as per the Implementation Schedule in **Section 9.5.5.**

While the *Operation ESMU (OESMU)* is expected to be established at least three (3) months prior commissioning.

(A) Construction ESMU (CESMU)

The CESMU will consist of the following:

- Core members of the ESMU (CLO, KTZ Quality Control / Technical Compliance Manager)
- Contractors / Subcontractors – Integra HSE Representatives, Poligram HSE Representative
- KTZ Land Manager and Land Surveyor (to assist in LRIT for resettlement)

- Subject Matter Experts (SMEs) – in Biodiversity, Environment and Social (LRP Implementation Team (LRIT))

The team will oversee:

- The overall execution of the ESMP during construction phase and follow strictly on CESMS.
- Monitor all activities within the ESMP within construction phase, including the management and monitoring plans.
- Address emerging issues as they arise, including reviewing trends and the nature of grievances.
- Review and evaluate monitoring results.

(B) Operation ESMU (OESMU)

The OESMU will consist of the following:

- Core members of the ESMU (CLO, KTZ Quality Control / Technical Compliance Manager)
- Operation and Maintenance (O&M) HSE Representatives
- Subject Matter Experts (SMEs) – in Biodiversity, Environment and Social (LRIT)

The team will oversee:

- The overall execution of the ESMP during operation and maintenance phase and follow strictly on OESMS.
- Monitor all activities within the ESMP after construction phase, including the management and monitoring plans for operation phase.
- The CLO will be responsible for addressing emerging issues as they arise, including reviewing trends and the nature of grievances, and will be trained to deal with GBVH-related matters.
- The ESMU is also expected to conduct periodic review and evaluation and monitoring of results. It is the responsibility of KTZ to manage E&S issues of the Project and to ensure necessary mechanisms are developed and implemented. The roles and responsibilities of the KTZ and EPC contractor regarding the ESMP is indicated in **Table 9-6**.

TABLE 9-6: KEY PARTIES RESPONSIBLE FOR THE IMPLEMENTATION OF THE ESMP

S.N.	Responsible party	Roles and responsibilities

1.	Developer and implementer of ESMP – KTZ, represented by Environmental and Social Management Unit (ESMU), Headed by KTZ Almaty PM	• Carry out the ESMP and related management plans while meeting all Project obligations.
		• Responsible for day-to-day oversight of the Project ESMP including the implementation of mitigation measures and management and monitoring plans during all phases of the Project.
		• Managing communication and engagement with stakeholders within KTZ and external stakeholders with accurate and regular reports.
		• Revise the ESMP as needed with any unexpected changes and revisions to be assessed and reviewed by the AIIB and IFC.
		• Coordinate and communicate actions and assessments in response to changes in engineering/design, location, applicable laws regarding environmental/social matters, or any new data introduced that affects Project execution.
		• Distribute the ESMP and management strategies to the EPC Contractor, assist in formulating their implementation plans, and provide approval for these plans.
		• Responsible for addressing any complaints and grievances in relation to Project activities.
		• Hire skilled Environmental, Health, and Safety (EHS) personnel and external specialists to support Project activities.
		• Conduct EHS training sessions for all personnel involved in the Project.
		• Perform environmental reviews, monitoring, and audits related to ESMP practices, assessing outcomes.
		• Report and inform the AIIB and IFC promptly about any project-related incidents or accidents that could significantly impact the environment or communities, including construction mishaps or environmental spills.
		• Provide detailed reports on incidents, including Root Cause Analysis findings, immediate actions taken, compensation provided, and relevant contractor or consultant information. Ensure these reports comply with the World Bank's Environment and Social Incident Response Toolkit (ESIRT).
		• If necessitated by AIIB/IFC, prepare a report on measures to prevent future incident occurrences.
		• Follow-up on potential E&S incidences.
		• Quality Control / Technical Compliance:
		  ○ Evaluate contractor operations to ensure adherence to ESMP stipulations.
		  ○ Verify compliance with project standards, implementing emergency measures when necessary to address non-compliance.
		• Chief Grievance Officer:
		  ○ Handle Grievances that get escalated to the Corporate level and that are not resolved at lower levels with the CLO and at the KTZ Almaty PM level.
		  ○ The Chief Grievance Officer should be trained to handle GBVH-related grievances.
		• Allocation of Funds:
		  ○ Accounting and handling the of funds disbursed from Lenders allocated for the Project.
		  ○ Conduct transparent accounting and disbursement of funds for the successful implementation of the SEP-GRM, ESMP, LRP-RF.
		  ○ Internal Monitoring and Evaluation on fund allocation, disbursement and usage.
		• KTZ Quality Control/Technical Compliance Manager:
		  ○ Ensure all construction activities comply with environmental laws, regulations, and permits applicable to the Project.
		  ○ Oversee environmental monitoring programs, including air quality, water quality, noise levels, waste management, and biodiversity protection, ensuring adherence to approved thresholds and local regulations (e.g.

S.N.	Responsible party	Roles and responsibilities
		Environmental Code, Land Code, Water Code, Forest Code, among others) ○ Establish and enforce strict adherence to safety protocols to prevent workplace accidents, injuries, and fatalities during construction. ○ Conduct regular risk assessments and hazard identification for all construction activities, ensuring preventive measures are in place. ○ Oversee the reporting and investigation of accidents, incidents, and near-misses. ○ Maintain records of all health and safety incidents ○ Ensure compliance (including compliance from contractors and subcontractors) with labour laws and human rights obligations. ○ Perform regular checks on contractors and subcontractors regarding labour practices, including but not limited to timely wage payments, accurate wage calculations, inclusion of overtime pay, and proper maintenance of workers' accommodations. • KTZ Human Resources Manager: ○ Ensure compliance (including compliance from contractors and subcontractors) with labour laws and human rights obligations. ○ Perform regular checks on contractors and subcontractors regarding labour practices, including but not limited to timely wage payments, accurate wage calculations, inclusion of overtime pay, and proper maintenance of workers' accommodations. • KTZ Land Acquisition Manager: ○ Liaise with the district Akimats as a representative of KTZ on the matters relating to land acquisition. • KTZ Land Surveyor: ○ Ensure boundaries are demarcated in consideration of the design and environmental receptors (in compliance with the law). ○ Collaborates with the design consultant (Poligram) to survey lands and provide feedback to optimise the project design. ○ Oversee the preparation of land prior to construction activities. ○ Ensure environmental safeguards are in place prior and during construction activities
2.	Design Engineer - Poligram	• Ensure all environmental and social considerations are integrated into the design and operational phases of the Project. • Supervise the implementation of specific mitigation measures outlined in the ESMP, such as pollution control systems, safety measures, and management plans. • Provide feedback and reports on design and operational performance concerning environmental and social objectives.
3.	EPC Contractor - Integra	• Compliance with ESMP: ○ Ensure all Project standards, ESMP requirements and associated management plans are met during the construction phase of the Project. ○ Create implementation and monitoring plans/procedures that align with the ESMP framework, proceeding with implementation after AIIB and IFC approval. ○ Execute mitigation measures and monitoring to minimise environmental impacts during construction phase. ○ Hire skilled EHS personnel and external specialists to support Project activities. ○ Support KTZ's EHS training sessions for all contractor and subcontractor staff involved in the Project. • Construction monitoring: ○ Perform inspections, checklists and audits related to ESMP practices, assessing outcomes. ○ Coordinate and supervise in third party monitoring, report to KTZ Almaty PM.

S.N.	Responsible party	Roles and responsibilities
		◦ Inform KTZ, AIIB and IFC promptly about any project-related incidents or accidents that could significantly impact the environment or communities, including construction mishaps or environmental spills. ◦ Report accidents and incidents while maintaining an incident log at the construction site throughout the Project's duration. ◦ Change Coordination as stated in **Row 1**. • Compliance: ◦ Report to KTZ periodically with ESMS performance reports. ◦ Practice accident/incident records register, grievance records, environmental monitoring records, employee/staff and worker details, trainings records and other E&S compliance at required intervals for submission to KTZ. • Integra PM: ◦ Ensure all construction activities comply with national environmental laws, local regulations, and the project's EMP. ◦ Obtain and maintain environmental permits and approvals required for the construction phase. ◦ Develop and enforce safety protocols to address construction-related hazards, ensuring the use of personal protective equipment (PPE). ◦ Conduct briefings and instructions on EHS-related topics (safe work procedures, environmental safeguard procedures) to all workers and contractors before commencing work. ◦ Prepare and submit detailed environmental performance reports to KTZ and regulatory authorities ◦ Implement corrective actions and maintain records to prevent recurrences. ◦ Ensure the contractors comply with the project's EHS policies and guidelines, including their adherence to EHS requirements in contracts. ◦ Escalate unresolved issues to KTZ Project Manager. ◦ Conduct safety induction programs and periodic training for all workers and contractors. ◦ Develop and maintain an emergency response plan to address potential incidents, including fire, spills, and accidents. ◦ Conduct emergency drills to ensure readiness among workers and contractors. ◦ Ensure prompt reporting, documentation, and investigation of all accidents, incidents, and near-misses. • Integra Environmental Specialist: ◦ Escalate environmental issues identified during the site monitoring to Integra Project Manager. ◦ Monitor air quality, noise, water quality, waste management, and soil protection measures to ensure compliance with environmental standards. ◦ Conduct regular environmental inspections and monitoring to assess adherence to the EMP as part of the control team who check on the quality of work along the alignment. ◦ Maintain accurate records of monitoring data and inspection findings. ◦ Escalate unresolved environmental issues to Integra Project Manager. ◦ Execute mitigation measures identified in the National EIA to minimise environmental impacts. ◦ Monitor and ensure mitigation measures identified in the National EIA are implemented during site monitoring. ◦ Implement corrective measures and continuous actions to safeguard the environment. • Integra EHS Manager: ◦ Ensure all construction activities comply with national environmental and labour laws, local regulations, and the Project's ESMP. ◦ Provide induction (in the form of briefings) for new hires. ◦ Implement all mitigation and safeguard measures identified in the Supplementary ESIA.

S.N.	Responsible party	Roles and responsibilities
		○ Participate in meetings and inspections to ensure consistent application of EHS standards across the project. ○ Ensure prompt reporting, documentation, and investigation of all accidents, incidents, and near-misses. ○ Ensure the development of appropriate emergency response plans. ○ Conduct EHS risk assessments for all construction activities/ activities to be engaged in. ○ Ensure EHS risk assessments are reviewed periodically (every six (6) months) and updated when required (e.g., after every accident/incident reported). • Integra Procurement Manager: ○ Conduct EHS screening of contractors and supply chain vendors. ○ Ensure contractors and supply chain vendors engaged are compliant to national environment and labour laws, local regulations and the project's ESMP. • Integra CLO: ○ Serve as the primary point of contact between the EPC Contractor, KTZ Project team and the local communities. ○ Facilitate regular meetings with community representatives to provide updates on Project activities and address concerns. ○ Communicate relevant project information, including timelines, potential impacts, and mitigation measures, to local communities in an accessible manner. ○ Provide advance notice of construction activities that may affect communities, such as road closures, increased traffic, or noise. ○ Manage the GRM by receiving, documenting, and addressing complaints or concerns from community members. ○ Ensure grievances are resolved in a timely and transparent manner and maintain records of all cases for reporting purposes. ○ Act as a mediator to resolve conflicts between the project team and local communities, ensuring fair and equitable outcomes. ○ Escalate unresolved conflicts to the appropriate Project personnel or KTZ. ○ Prepare and submit regular reports on community engagement activities, grievances, and resolutions to the EPC Contractor's management and Project owner. ○ Maintain accurate records of interactions with communities and any actions taken • Integra HR and Admin Officer: ○ Ensure that all required labour licenses, permits, and registrations are obtained and maintained in compliance with local labour laws and regulations. ○ Coordinate with relevant authorities to address any issues related to labour licensing and workforce permits. ○ Ensure that the workforce management complies with applicable labour laws, including those related to working hours, leave policies, and benefits. ○ Monitor adherence to regulations regarding the hiring of local and migrant workers as required by project commitments and local laws. ○ Ensure that all workers, including contractors and subcontractors, are paid at least the minimum wage as per local laws and project standards. ○ Conduct periodic audits to verify compliance with wage payment requirements. ○ Monitor overtime work to ensure compliance with labour laws and that workers are compensated at the prescribed overtime rates. ○ Maintain records of working hours and overtime to ensure transparency and legal compliance. ○ Act as the focal point for addressing grievances and disputes related to labour and working conditions.

S.N.	Responsible party	Roles and responsibilities
		○ Ensure that grievances are resolved promptly and fairly, in alignment with the Project's GRM. ○ Regularly supervise subcontractors to ensure their adherence to labour, wage, and overtime regulations as well as project policies. ○ Conduct periodic inspections and audits of subcontractor records, including employment contracts, payroll, and working conditions. ○ Collaborate with the EHS team to ensure alignment between labour rights and health and safety practices. ○ Provide subcontractors with guidance on labour law compliance, ensuring their alignment with the EPC Contractor's standards. ○ Address non-compliance issues with subcontractors and implement corrective actions as necessary. ○ Prepare and submit regular reports on workforce management, including labour license status, compliance with wage and overtime regulations, and any workforce-related grievances.
4.	Operational Contractors / O&M HSE	• Compliance with ESMP during operational phase: ○ Ensure all Project standards, ESMP requirements and associated management plans are met during the operation phase of the Project. ○ Create implementation and monitoring plans/procedures that align with the ESMP framework, proceeding with implementation after AIIB and IFC approval. ○ Execute mitigation measures and monitoring to minimise environmental impacts during operation phase. • Hire skilled EHS personnel and external specialists to support Project activities. • Support KTZ's EHS training sessions for all contractor and subcontractor staff involved in the Project. • Operational monitoring: ○ Perform inspections, monitoring, checklists and audits related to ESMP practices, assessing outcomes. ○ Inform KTZ, AIIB and IFC promptly about any project-related incidents or accidents that could significantly impact the environment or communities, including operation mishaps or environmental spills. ○ Report accidents and incidents while maintaining an incident log during operation. • Compliance: ○ Report to KTZ periodically with ESMS performance reports. ○ Practice accident/incident records register, grievance records, environmental monitoring records, employee/staff and worker details, trainings records and other E&S compliance at required intervals for submission to KTZ. • Coordinate with project stakeholders, including local communities, regulatory authorities, and non-governmental organisations (NGOs), to address E&S concerns. • Act as a point of contact for grievances and complaints related to the project's E&S impact. • Adopt adaptive management by identifying emerging risks and updating practices to address them. • Collaborate with KTZ and ESMP Implementation team to revise and improve ESMP as necessary.
5.	Community Liaison Officer (CLO)	• Help to maintain good relations between KTZ and members of the community. • Provide written and verbal updates to those working and living in the communities before/during/after the implementation of the ESMP activities. • Facilitate negotiation process, where applicable, or direct the affected persons to the responsible parties and officers in charge (biodiversity, environmental, social, contractors, KTZ Project Manager, etc). • The CLO shall be trained to handle GBVH-related grievances.

S.N.	Responsible party	Roles and responsibilities
		• The CLO will be responsible for handling grievances between all PAEs and the community and relay the information back to the KTZ Almaty PM or the KTZ Headquarters, KTZ Corporate Grievance Officer. • Responsible for handling grievances as indicated in the SEP-GRM, LRP and ESMP.
6.	Biodiversity Specialist	• Monitor biodiversity aspects of the project. • Evaluate biodiversity impacts from project activities and the effectiveness of mitigation measures. • Oversee biodiversity conservation measures and provide feedback for adaptive management. • Collaborate with stakeholders including local communities and NGOs.
7.	Environmental Specialist	• Monitor environmental aspects of the project. • Ensure compliance on environmental laws, regulations and standards. • Support development and implementation of pollution control and management plans.
8.	Social Specialist (Livelihood Specialist, as part of the LRP Implementation Team (LRIT))	• Monitor social aspects of the project. • Ensure compliance on social laws, regulations and standards. • Support development and implementation of social management plans including SEP and LRP. • Oversee the execution of livelihood restoration programs. • Monitor all activities within the LRP, including the implementation of livelihood restoration initiatives and engagement with land-affected households and impacted communities. • Foster trust among stakeholders. • Address emerging issues as they arise, including reviewing trends and the nature of grievances. • Review monitoring results.
9.	Third Party Monitoring Entity	• Provide independent oversight, assessment and reporting on project's adherence to E&S standards. • Ensure construction and operation contractors fulfilling their responsibilities by monitoring. • Evaluate the implementation of mitigation measures and verify effectiveness with collected data. • Offer suggestions and guidance to contractors or KTZ on improving compliance and E&S performance.

9.5.3 TRAINING

The environmental and social training will help to ensure that the requirements of the ESMP are clearly understood and followed by all project personnel. The Supervision Engineer will be required to conduct the E&S training, the competencies of the Supervision Engineer training team for capacity building training will include a thorough knowledge and experience of IFC PS. The trainings will be provided to different professional groups separately, such as managers, skilled personnel, unskilled labours, and camp staff.

For construction phase, Integra Project Manager, with the assistance from KTZ Project Manager, will ensure that the EHS induction training and job specific trainings are identified and given to the required personnel. The following trainings (but not limited to) shall be conducted to encourage the implementation of environmentally and socially sound practices and compliance requirements in **Table 9-7**. Refer to CESMS Section 7 for details on training and capacity building.

TABLE 9-7: ENVIRONMENTAL AND SOCIAL TRAINING REQUIREMENTS

S.N.	Type of Training	Phase	Frequency	Trainer	Site Supervisors & Security	Railway Corridor Monitoring Officer	Staff
1.	Occupational health and safety (including, but not limited to, need and usage of PPEs, work permit system, on-job hazard analysis, excavation safety, electrical safety, material handling, scaffold safety, etc.)	Construction and operation	Mandatory induction for new joiners: basic health and safety training for all employees and contractors; additional job-function specific training for relevant personnel (employees and contractors) Daily brief toolbox meeting on relevant health and safety topics (e.g. PPE, equipment safety, emergency procedures) at the start of the work shift. Monthly topic-specific training sessions that are more in-depth (different training sub-topics may be selected for various months)	Contractor EHS Manager supported by Contractor Project Manager and KTZ Project Manager	√	√	√
2.	Emergency preparedness and response	Construction and operation	Quarterly	Contractor Project / Supervision Manager	√	√	√
3.	Behavioural aspects (including, but not limited to, conversation with peers, supervisors and general public, prevention of sexual harassment, defensive driving, etc.)	Construction and operation	Monthly	Contractor Project Manager supported by KTZ Project Manager	√	√	√

S.N.	Type of Training	Phase	Frequency	Trainer	Site Supervisors & Security	Railway Corridor Monitoring Officer	Staff
4.	Standard operating procedures/ steps to be followed for various project works	Construction and operation	Daily before start of the work	Contractor EHS Manager supported by Integra Project Manager	√	√	√
5.	Health and hygiene	Construction and operation	Monthly	Contractor EHS Manager supported by Integra Project Manager	√	√	√
6.	Traffic diversion and road safety	Construction and operation Construction and operation	Quarterly	Contractor EHS Manager supported by Integra Project Manager	√	√	√
7.	First aid awareness	Construction and operation	Quarterly	Contractor EHS Manager supported by Contractor Project Manager	√	√	√
8.	Environment and biodiversity awareness	Construction and operation	Quarterly	Contractor Environmental Specialist supported by Contractor Project Manager	√	√	√

S.N.	Type of Training	Phase	Frequency	Trainer	Site Supervisors & Security	Railway Corridor Monitoring Officer	Staff
9.	Waste management	Construction and operation	Monthly	Contractor EHS Manager supported by Contractor Project Manager	√	√	√
10.	ESMP Requirements (including associated management plans) and legal compliance	Construction and operation	Quarterly	Contractor Project Manager supported by KTZ Project Manager	√	√	x
11.	Reporting and investigation of incidents	Construction and operation	Quarterly	Contractor Project Manager supported by KTZ Project Manager	√	√	√
12.	Stakeholder engagement and grievance mechanism	Construction and operation	Quarterly	Contractor Project Manager supported by Contractor's CLO, HR & Administration Officer and KTZ CLO and Human Resources Manager	√	√	√

9.5.4 ESMP IMPLEMENTATION BUDGET

KTZ and the EPC Contractor will review their contractual agreements to see if budget has been allocated to environmental and social management, training, environmental monitoring, analysis and reporting, verification monitoring and capacity building. KTZ and the EPC should implement the ESMP together. It should be noted that costs for many in-built commitments or embedded controls, such as, acoustic enclosures for noise control, wastewater treatment, etc., should have already been included in the EPC contract cost estimate and/or operating cost estimates.

The budget for implementing the Biodiversity Management Plan should be undertaken by KTZ, and the implementation should be in collaboration between the EPC and the biodiversity specialist, with KTZ oversight.

In addition, a separate budget will be allocated for Community Engagement activities and Livelihood Restoration Options (for the implementation of the LRP), which will be conducted by the KTZ. The budget for the implementation for the LRP / RF can be found in the LRP / RF.

The following costs are indicative and subject to discussions with AIIB/IFC and KTZ.

TABLE 9-8: ESMP IMPLEMENTATION BUDGET

S.N.	Aspect	Description of Item	Quantity	Unit	Cost/unit	Item Total (USD)
A	**Construction Stage (2 years)**					
1	General	Contractors preparation of C-ESMP	-	-	-	Included in Construction Cost
2	General	Contractors ESHS Staff including environmental, social and biodiversity specialists	-	-	-	Included in Construction Cost
3	General	Site/OHS facilities for workers (PPE)	1	LS	-	$50,000.00
4	Safety	Training of Workers on Code of Conduct for Health and Safety	1	LS	-	$100,000.00
6	Air Quality	Dust Management - watering and dust suppression	1	LS	-	$100,000.00
7	Construction Noise	Construction noise blankets (2-meter-high noise barrier) – estimated 1km in length	10	per 100m	$16,000.00	$160,000.00
8	Biodiversity	Wildlife-friendly fencing where necessary	5	per km	$20,000.00	$100,000.00
9	Biodiversity	Biodiversity Assessment, related inspection and monitoring	1	LS	-	$150,000.00
10	Environmental	Construction environmental monitoring by a third party (2 years as detailed in **Section 9.4.2.3** - air, noise monitoring at sensitive receptors, surface water quality monitoring	1	LS	-	$200,000.00
11	Social	LRP Implementation - land acquisition, resettlement, compensation	1	LS	-	Refer to LRP
					Sub-total:	**$860,000.00 ++**
B	**Operation Stage (5 years)**					
12	Safety	Operational training as per **Section 9.5.3**	5	per year	$35,000.00	$150,000.00
13	Environmental	Ongoing environmental monitoring during operation (as detailed in **Table 9-5**)	5	per year	$60,000.00	$300,000.00
14	Biodiversity	Biodiversity Management Plan Implementation	1	LS	-	Refer to BMP

S.N.	Aspect	Description of Item	Quantity	Unit	Cost/unit	Item Total (USD)
15	General	Auditing	5	per year	$10,000.00	$50,000.00
					Sub-total:	**$500,000.00**
					Grand total:	**$1,360,000.00**
16	Optional	Railway Noise Barrier[346]	1	per km	**$650,000**	**$650,000**

[346] According to IFC Environmental, Health, and Safety Guidelines for Toll Roads (2007), The most effective noise abatement measures include noise barriers and mounds, which can reduce noise by 5 dBA or more. The cost of noise walls in the US has been estimated at $1.3 million per mile (NCHRP Project 25-25 (04)).

9.5.5 ESMP IMPLEMENTATION SCHEDULE

This section of the report details the implementation process and timeline necessary to complete the various activities outlined in the proposed ESMP. The project is currently in the construction phase, and the implementation of the ESMP will be coordinated with ongoing activities to ensure compliance for E&S standards.

An indicative timeline for the implementation of the ESMP is presented in **Table 9-9** below.

TABLE 9-9: PROPOSED TIMELINE FOR ESMP IMPLEMENTATION

No	Activity	Stakeholder Implementer	Completion Period	Proposed Completion Date
1	Approval of Final ESMP	Lenders, KTZ,	Within 1 month of approval of final documents	April 2025
2	Establishment of the GRM (from SEP-GRM)	KTZ	Within 1 month of approval of final documents	April 2025
3	Disclosure of Supplementary ESIA (Non-Technical Summary) • Online Disclosure (30 days) • Public Disclosure (60 days) at District level	Lenders, KTZ, CLO, Regulatory Authorities, Local Communities	Within 30-60 days of approval of final documents	April -May 2025
4	Disclosure of SEP-GRM to stakeholders: • Corporate • Labour / Workers / Contractors/ Subcontractors Community	KTZ, CLO, Regulatory Authorities, Akimats	Within 30-60 days of approval of final documents	April -May 2025
5	**Establishment of the ESMU** (Refer to **Section 9.5.2.2**)	KTZ	Within 1 month after disclosure of Supplementary ESIA	May-June 2025
6	Hiring/Appointment of KTZ Project Manager in charge of the ESMP, Community Liaison Officer and External Monitoring agency	KTZ	With the establishment of the ESMU	May-June 2025
7	Contractor training on ESMP	KTZ, Contractor	Within 1 month of finalisation of the ESMU.	May-July 2025

No	Activity	Stakeholder Implementer	Completion Period	Proposed Completion Date
8	Environmental Monitoring	Contractor, Environmental Specialist	Continuous Process, to be carried out all through the activity period. Refer to **Section 9.4.2.3** for monitoring schedule.	
9	Biodiversity Monitoring	Contractor, Biodiversity Specialist	Continuous Process, to be carried out all through the activity period. and BMP for monitoring schedule.	
10	Social Monitoring	Social Specialist, CLO	Continuous Process, to be carried out all through the activity period. Refer to **Section 7** and LRP for monitoring schedule.	
11	Program Implementation Monitoring-Quarterly	KTZ, CLO, ESMU, LRIT	Continuous Process, to be carried out all through the activity period for ongoing progress of ESMP and LRP-RF implementation.	
12	Program Implementation Monitoring-Semi-annually	External Monitoring Agency	Continuous Process, to be carried out all through the activity period.	
13	Evaluation of each Training Program	KTZ, CLO, ESMU, LRIT	Continuous Process, to be carried out after completion of each activity and efficacy of the various Programs imparted has to be evaluated by continuous engagement with the PAEs and reported to the KTZ management at quarterly intervals for any intervention or enhancement required.	
14	Follow up of activities	KTZ, CLO	Continuous Process, to be carried out after completion of each activity.	
15	Mid Term Evaluation	External Monitoring Agency	June 2026 (15 months from the commissioning).	
16	Final Compliance Audit	External Monitoring Agency	March 2028	
17	Preparation of Final Compliance Report	KTZ	March 2028	

No	Activity	Stakeholder Implementer	Completion Period	Proposed Completion Date
18	Operation ESMS development including safety management system	KTZ	6 months prior to commissioning	

9.6 REPORTING

The reports required during construction are summarised in the table below. The reports described below are to be issued to the Lenders, including for reports for which are the contractor's responsibility (which have to be channelled to the Lenders via KTZ).

TABLE 9-10: LIST OF REPORTS DURING CONSTRUCTION

Report	Description	Responsible Party	Frequency of Reporting
Environmental and Social Monitoring Reports	These reports document the ongoing monitoring of environmental and social impacts, implementation status of proposed mitigation measures, monitoring against KPIs set and compliance status against national regulations, the ESMP, and donor or investor requirements.	ESMP Implementation Team, based on inputs from the contractor and the Supervision Engineer	Quarterly during construction.
Incident/Non-compliance Reports	These reports document any incidents, accidents, or non-compliance with environmental and social safeguards, investigation report and any status of proposed corrective actions taken.	The contractor, with oversight from the Supervision Engineer and ESMP Implementation Team.	All fatalities and major incidents need to be reported to the Lenders within 24 hours of the event occurrence. Other incidents are to be reported to the Lenders in accordance with the timescales set out in the loan documentation.
Health, Safety, and Environmental (HSE) Reports	These include details on workplace safety, environmental management practices, and health conditions and statistics non the project operations, such as volume of waste generated, lost time	The contractor, under the supervision of the Supervision Engineer.	Monthly during construction.

Report	Description	Responsible Party	Frequency of Reporting
	injury (LTI) rates, first aid kit incidences etc.		
Progress Reports	These reports shall include the monthly project progress, status on land clearing, any incidences recorded, equipment maintenance and workforce statistics.	Supervision Engineer.	Monthly during construction.
Training and Capacity Building Reports	These track the training sessions provided to project staff, contractors, and local workers on environmental and social issues.	The contractor, with support from the ESMP Implementation Team and any appointed environmental or social specialists.	Quarterly during construction.
Grievance Redress Mechanism (GRM) Reports	These documents any complaints or grievances raised by local communities or workers, detailing how they were resolved.	The contractor, in coordination with the LRP Implementation Team.	Monthly during construction.

9.7 DISCLOSURE TO AFFECTED COMMUNITIES

The Supplementary ESIA-ESMP is expected to be disclosed online (within 30 days of final approval) and to the public at District level (within 60 days of final approval), as well as village and other administrative unit levels along the alignment, in the local language (Kazakh and/or Russian) and English. The Supplementary ESIA-ESMP will be disclosed after the final approval of the SEP-GRM, ESMP, and LRP-RF. At time of the Disclosure of the Supplementary ESIA, the establishment of the ESMU, the LRIT and the functioning GRM is expected to be in place.

During the implementation of the ESMP, the ESMU and the CLO will be in charge of disclosing the ESMP activities to the community. Should the community members have concerns and/or comments during the implementation of activities listed in the ESMP, they are able to raise these via grievance redressal mechanism tools listed in the SEP-GRM. The proposed activities and schedule of engagements can be found in the SEP-GRM.

The Akimats will also play a crucial role in supporting the ESMP Implementation Team in disclosing information to the affected communities

9.8 CHECK AND FEEDBACK

The process of regular E&S audits is critical to ensuring that the project's ESMP remains effective and that KTZ complies with agreed objectives and targets. Regular EHS and Social audits should be undertaken by KTZ’s Quality Control / Technical Compliance Manager at the ESMU. These audits will be a key part of performance monitoring, as they will not only assess the construction and operational activities but will also focus on the implementation and effectiveness of the ESMP. The ESMP will therefore be subject to review and development at least once annually to ensure that it remains appropriate for all aspects of Project operations. All audit findings should be reviewed by KTZ’s Quality Control / Technical Compliance Manager at the ESMU for all phases of the Project. Where preventive/ corrective actions are deemed necessary, correction and corrective action shall be taken without undue delay for any process that does not conform to the requirements. Further details regarding construction phase audits and roles and responsibilities across corporate level (i.e. KTZ Astana), network level (i.e. companies that are part of KTZ) and local level (i.e. regional railway networks, branches and affiliations of KTZ companies) can be found in the Construction ESMS manual. This process ensures that performance monitoring is integrated across all phases of the project, enhancing accountability and ensuring that environmental and social impacts are managed effectively throughout the project's lifecycle.

9.9 PERFORMANCE MONITORING AND REPORTING

Regular assessment and monitoring reports should be issued by KTZ to demonstrate the delivery of regulatory conditions and of commitments for both external stakeholders and for internal assurance. Monitoring reports should be disclosed at Talgar, Iliy, Karasay, Zhambyl and Alatau City Akimat offices and through a website that indicates project progress and an evaluation of the performance of the ESMP. In addition, it is understood that the ESMU will provide implementation reports to the KTZ Astana team for further communication and disclosure to the lenders (i.e. IFC, AIIB and other entities). Further details on performance monitoring and reporting can be found in the Construction ESMS manual, and SEP -GRM.

APPENDIX A PROJECT COMPONENTS

APPENDIX B ASIAN GAS PIPELINE

APPENDIX C AIR EMISSION SOURCES

APPENDIX D CRITICAL HABITAT ASSESSMENT

APPENDIX E MINUTES OF STAKEHOLDER ENGAGEMENT

APPENDIX F CULTURAL HERITAGE MANAGEMENT FRAMEWORK

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ERM
20 Collyer Quay, #15-01/02
Singapore 049319

T: +65 6324 9636
F: +65 6722 0749

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