“ULAANBAATAR PUBLIC TRANSPORT PROJECT “LIGHT RAIL TRANSIT (LRT) FROM THE GENERAL ARCHIVES TO SUKHBAATAR SQUARE”

Environmental and Social Due Diligence

Environmental and Social Analysis Report

2025

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1. INTRODUCTION

1.1 Scope of Work

Develop Environmental and Social Due Diligence (ESDD) Report for the proposed "Ulaanbaatar tram project from the general archives to sukhbaatar square" Project (Proposed Project). The ESDD has been prepared based on Environmental and Social Policy (ESP) and Performance Requirements (PRs), 2019[1]. Scope of work:

- Draft Compliance Summary table with the Bank's PRs (see Table 3-3);
- Describe and characterise a relevant environmental and social baseline[2];
- Conduct scoping level assessment to identify potential environmental and social impacts.
- Draft Environmental and Social Mitigation Measure with relevant Management Plans (See Section 5)

Please note that the specific scope of work may vary depending on the project needs and Client requirements.

1.2 Objectives

The objective of the assignment is to identify and assess the potentially significant existing and future adverse environmental and social impacts due to the proposed Project activities, assess compliance with applicable national environmental, social, and health and safety legislation and the ESP and PRs, determine the measures needed to prevent or minimise and mitigate the adverse impacts, and identify potential environmental and social opportunities, including those that would improve the environmental and social sustainability of the proposed Project.

1.3 Project Categorisation

EBRD categorises each project 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 environmental and social impacts, which are new and additional. Project categorisations[3] are detailed below:

- A project is categorised A when it could result in potentially significant environmental and/or social impacts, including direct and cumulative environmental and social impacts, which are new and additional and, at the time of categorisation, cannot readily be identified or assessed. Projects categorised as A[4] require a formalized and participatory environmental and social impact assessment process.
- A project is categorised B when its potential environmental and/or social impacts are typically site-specific, and/or readily identified and addressed through effective mitigation measures.
- A project is categorised C when it is likely to have minimal or no potential adverse environmental and/or social impacts.

The proposed Project does not involve "greenfield" or major extensions or transformation-conversion of any Category A components as listed by EBRD in the indicative list of Category A[5] projects.

[1] https://www.ebrd.com/home/news-and-events/publications/institutional-documents/environmental-and-social-policy-2019.html
[2] BGM Distribution LLC. 2025. Environmental baseline assessment report for "ulaanbaatar public transport project "Light Rail Transit (LRT) from the general archives to sukhbaatar square" project.
[3] https://www.ebrd.com/home/news-and-events/publications/institutional-documents/environmental-and-social-policy-2019.html
[4] A list of Category A projects is presented in Appendix 2 of the ESP,2019.
[5] https://www.ebrd.com/home/news-and-events/publications/institutional-documents/environmental-and-social-policy-2019.html

In respect of above mentioned categorisations, the “Ulaanbaatar tram project from the general archives to sukhbaatar square” Project (Proposed Project) is a category B. The results of Environmental and Social assessment represent potential future adverse impacts associated with the Project, identify potential improvement opportunities, and include list of measures needed to avoid, or where avoidance is not possible, minimise and mitigate adverse impacts.

2. Legal and Institional Framework

This section provides an overview of the European Bank for Reconstruction and Development (EBRD) and national policy, legal, and administrative framework of relevance to the proposed "Ulaanbaatar tram project from the general archives to sukhbaatar square" Project (proposed Project), covering the national environmental, social, and health and safety legislation, as well as EBRD's Environmental and Social Policy (ESP) and Performance Requirements (PRs), 2019[6].

2.1 National Legal and Institutional Framework

Mongolia is a parliamentary republic with a unicameral parliamentary legislature called the State Great Khural (SGKh). Representatives of the SGKh are elected through direct universal suffrage for four-year terms. The Constitution of Mongolia, adopted in 1992, restructured the government's legislative branch and defines the character, composition, and powers of key state executive, legislative, and judicial bodies. In November 2019, Mongolia approved the second set of amendments to its 1992 Constitution. These amendments were novel because of the extent of deliberation and public engagement[7] also Presidential elections which took place every four years have been changed to once every six years with the incumbent allowed to service in the office only once instead of two.

On May 31, 2023, the Mongolian parliament passed a major constitutional reform to enlarge the legislative body from 76 members to 126. The change will impact Mongolia's electoral system and governance. The key elements of the current amendment are the enlargement of the legislature, re-introduction of a proportional component to the parliamentary elections, introduction of indirect presidential elections, and changes to the constitutional court[8].

The fundamental rights of Mongolian citizens are set out in the 1992 Constitution, including "the right to a healthy and safe environment, and to be protected against environmental pollution and ecological imbalance". The constitution imposes on its citizens a sacred duty "to protect nature and environment" and empowers the GoM "to undertake measures on the protection of the environment and on the rational use and restoration of natural resources". More specifically, the constitution imbues the State with the right to hold landowners responsible in connection with the land, to exchange or confiscate it with compensation on the grounds of special public need or if it is used in a manner adverse to the health of the population, the interests of environmental protection or national security.

Administratively, Mongolia is divided into Aimags, which are further divided into soums (districts). The lowest level of administration is the Bag, or sub-district and consists of a Bag Governor, Civic Registration Officer, and Section Leaders. The Governor's responsibilities are defined by legislation. Each Bag has its own budget regulated by law, although the soum Governor's Office typically manages the budgets. Bags have limited discretion over maintenance costs, pensions, and honorary prizes for exemplary workers, citizens, and taxpayers.

At the Aimag and soum levels, self-governing bodies called Citizens Representative Khurals (CRK) or khurals are responsible for local governance. At the Bag level, the self-governing body is the Bag General Meeting. Khurals are elected for four-year terms and have the authority to discuss and make decisions on economic, social, and organizational matters, except for those legally defined within

[6] https://www.ebrd.com/home/news-and-events/publications/institutional-documents/environmental-and-social-policy-2019.html
[7] Mongolia's Long, Participatory Route to Constitutional Reforms | Constitution Net
[8] Mongolia's Constitutional Reform Enlarges Parliament, Advances a Mixed Electoral System – The Diplomat

the powers of higher-level government bodies. At the soum level, funding is primarily delegated from the national government.

The Aimag-level government institutions mirror those at the national level, with the Governor being the central authority. Governors represent the State and directly report to higher-level Governors. The Governor of Aimag or city is nominated by the respective Khural and appointed by the Prime Minister. A typical Province Governor's Office consists of various departments, including Public Administration Management, Legal, Investment, Development Policy and Planning, Social Policy, Finance and Treasury, Monitoring, Evaluation and Internal Audit, Veterinary, and Military Section. The number of staff in Province Governor's Office may vary based on local characteristics, territory size, population, and economic and industrial development scale.

The 2019 constitutional reform represents a tremendous political shift in Mongolia's governance, political parties, and local councils. There are four changes related to the administrative divisions. Following the initiatives of the Government, the parliament would be allowed to delegate functions of the administrative divisions to the cities or towns and to change the administrative divisions on the basis of proposals of local citizens. In order to encourage local economic development, the amendments would allow the local councils (the Khurals of Citizen Representatives) in Aimags, capital city, counties and districts to fix the amount of taxes and to manage ownership within the limits defined by law. Moreover, the presidiums of local councils, which currently exercise most of the powers of the local councils during the interval period between the sessions of the local councils, would be eliminated so that the local councils fully exercise their respective powers.

2.1.1 National Legislation Related to the Project Framework

The propsed Project will entirely operate within the Mongolian national laws as identified in the Table 2-1, but not limited. The Government of Mongolia undertook a major environmental law reform in 1990 including the law of land, protected areas, water, forest, wildlife, and native flora resources. Most of the major laws were revised in 2012. The key national environmental, labor, health and safety laws are described in the in the Table 2-1, whereas standards are shown in Table 2-2.

Table 2-1 Related laws and brief description

№	Laws	Year	Description
Laws relating to the Environment			
1	Law on Land	2002, last amended in 2015	Identifies requirements for the various types of land depending on the use, and includes common requirements, sanitary requirements, pasture protection, protection of hayfields and cultivated areas. Specific requirements that apply to this project include the requirement to rehabilitate, or to "immediately restore eroded and damaged land", and "Land users should "prevent adverse impacts to the environment and land due to use of the land".
2	Law on Soil Protection and Prevention from Desertification	2012	This law includes measures to prevent desertification from the intensification of agriculture, mining, road construction, and urban land use as well as climate change. The law provides guidance to facilitate a safe and healthy environment for the population, and to prevent soil damage and lower soil fertility from overgrazing and desertification, and systems to prevent soil erosion. The law also contains measures to establish accountability in environmental protection along with more elaboration on soil degradation, desertification gradation criteria and soil assessment methodology.

№	Laws	Year	Description
3	Law on Subsoil	1995	The Law on Subsoil regulates the use and protection of subsoil in the interests of present and future generations.
4	Law on Water	2012	This Law makes provision with respect to the proper use, protection and restoration of water resources of Mongolia. The purpose of the Law is to govern relations concerning the protection and rational use and restoration of water resource and its basin.
5	Law on Environmental Protection	1995, last amended in 2012	The Law on Environmental Protection: regulates relations between the state, citizens, economic entities, and organizations to guarantee the human rights to live in healthy and safe environment, have ecologically sustainable social and economic development. It is an umbrella Law for protection of land and soil; natural and mineral resources and minerals (on and underground); water; plants; animal and air.
6	Law on Environmental Impact Assessment	2012, last amended in 2024	Environmental impact assessment in Mongolia is guided by the Law on Environmental Impact Assessment (2012) which is administered by the Ministry of Environment and Tourism (MET). The EIA protocol for all project interventions is two tiers defined initially by a general EIA (GEIA) - initial screening, followed by either a full detailed EIA (DEIA) or an Environmental Management Plan (EMP). The initial GEIA is generally conducted by the MET which identifies the required level of further impact assessment of a project. For major projects, GEIA prescribes the follow-up requirement of DEIA, whereas for minor impact projects, GEIA can prescribe only an environmental management plan (EMP) to be prepared for the project. DEIA (detailed environmental impact assessment) shall be conducted by the local organization that is authorized according to the Article 12 of the law. The authorized entity that is defined within the Article 8.2 of this law, shall prepare the report with the detailed environmental impact assessment and develop the environmental management plan. It is required to reflect the official feedback provided by the project implementer in detailed environmental impact assessment report. The environmental officer of the local area, the state environmental inspector, all Governors of every level, and the government agency in charge of geology and mining affairs shall monitor whether the project implementing citizen or the entity has conducted the environmental impact assessment.
7	Law on special protected areas	2017	The Law regulates the use and procurement of land for state protection, fosters scientific research, and preserves and conserves the land's original condition in order to protect specific characteristics, unique formations, rare and endangered plants and animals, historic and cultural monuments, and natural beauty. The law establishes four protected area categories, each managing land for a different purpose under a separate management directive. These

№	Laws	Year	Description
			include Strictly Protected Areas (SPA), National Parks (NP), Nature Reserves (NR) and National Monuments (NM).
8	Law on Air	2012, last amended in 2018	This law prohibits the pollution of urban air with "toxic and infectious substances and wastes with offensive odors", requires EIAs prior to engaging in commercial activities which discharge polluting substances, and further regulates five specific activities for air quality protection. These are discharge and burning of wastes, construction activities, equipment emitting air pollutants, discharge of greenhouse gases and activities affecting the ozone layer.
9	Law on natural plants	1995	It regulates the protection, proper use, and restoration of natural plants other than forests and cultivated plants.
10	Law on Waste management	2017	This law regulates waste disposal and recycling, reward system for collected recyclable wastes, and an accountability system for individuals and organizations that violate waste disposal regulations.
11	Law on Hydrology, Meteorology and Environmental Monitoring	1997, last amended in 2017	This law regulates relationship relating to providing citizens, business entities and organizations with information on hydrology and meteorology.
12	Law on Protection of Cultural Heritage	2014	The law regulates the collection, registration, research, classification, evaluation, preservation, protection, promotion, restoration, possession and usage of cultural heritage including tangible and intangible heritage.
13	Law on Natural Resource Use Fees	2012, last amended in 2015	This law regulates relations concerning imposing fees for use of natural resources to citizens, economic entities and organizations and spending the fund from proceeds from use of natural resources for environmental protection and restoration of natural resources
14	Law on Energy Conservation	2015, last amended in 2016	This law regulates the relations arising from energy conservation and efficient use of the energy.
Laws relating to the labor, occupational safety and health			
15	Law on Labor	2021, last amended in 2024	The project is subject to this law because the labor force will be employed during the construction and operation. This law aims to ensure equality in labor relations between employees and employers by defining roles, responsibilities and rights of them, work condition and terms of employment.
16	Law on Promoting Gender equality	2011, last amendment in 2024	Aims to eliminate gender discrimination and ensure equality across all sectors, with mandates for equal employment rights and harassment-free workplaces.
17	Law on Child Protection	2016, last amendment in 2024	Establishes a national framework for preventing and responding to violence, exploitation, and neglect of children.
18	Law on Human Rights of Persons with Disabilities	2016, last amendment in 2024	Ensures inclusive development, prohibits employment discrimination, and mandates equal social participation for persons with disabilities.

№	Laws	Year	Description
19	Law on Combating Human Trafficking 2012	2016, last amendment in 2024	Defines institutional roles for preventing trafficking, protecting victims, and addressing its root causes through coordinated programs.
20	Law to Combat Domestic Violence	2016, last amendment in 2024	Protects victims of domestic violence, holds perpetrators accountable, and involves multiple stakeholders in prevention and response.
21	Law on Promotion of Gender Equality	2011	Article 5 has defined the principle of gender equality as "men and women shall have opportunities and conditions to enjoy and to equal participate in political, economic, social, cultural, family and other relations, and to equally participate in social life and equally access the benefits of development and social wealth.
22	Law on Fire Safety	2015	This law ensures fire safety, establishes the legal basis of the authority in charge of fire safety monitoring, defines the rights and duties of local administrative bodies, business entities and citizens for ensuring fire safety and governs relationships connected with the exercise of such rights and duties.
23	Law on Hygiene	2016	This law regulates relations relating to create healthy and safe environment to live, prevent from any actions and activities that has adverse impacts to human health and environment, reduce and eliminate those impacts.

Mongolian Policy documents to comply for Social Management Plan:

- Mongolian Gender Policy: Guides the implementation of gender-responsive planning and programs to eliminate discrimination and promote equality across all sectors.
- Construction and Urban Development Sector Gender -Responsive Policy 2018: Promotes gender equity in construction by setting anti-discrimination standards, workforce quotas, and inclusive HR strategies.
- Population, Labor and Social Protection sector Gender -responsive Policy: Strengthens gender equality mechanisms in labor and social protection through policy support, capacity building, and mainstreaming efforts.

Table 2-2 National Standards Related Environment and Social Aspects

Name of the standards	Codes
Environmental aspects	
Air quality. Acceptable concentration of pollutant elements for atmospheric air in public area	MNS 6063:2010
Air quality. General technical requirements	MNS 4585:2016
Environmental Protection: Rehabilitation of eroded land, terms and definitions	MNS 17.5.13. 1980
Environment. Land reclamation. Terms and definitions	MNS 5914:2008
Environment Requirements for fertile soil removing and its temporary storage during the earth excavation	MNS 5916:2008
Environment. Re-vegetation of destroyed land. General technical requirements	MNS 5918:2008
Acceptable concentration of air pollutant elements. General technical requirements	MNS 5885:2008
Water quality. General requirements	MNS 3342:1982

Name of the standards	Codes
General requirements for preventing from groundwater pollution	MNS 4586:1998
Environment protection. Soil. The norm for sanitary condition of soil in town and residential areas	MNS 3297:1991
Plant quarantine. Terms and definitions	MNS 3475:2003
Water quality. Sampling. Part 4: Guidance on sampling of groundwater	MNS ISO 5667-11:2000
Water quality. Effluent treated wastewater. General requirements	MNS 4943:2015
Soil quality. Soil pollutants elements and substance	MNS 5850:2008
Soil. General requirements for sampling	MNS 3298:1991
Soil. Procedure for sampling, packaging, transportation and storage	MNS 2305:199
Identification of wastewater discharge point. General requirements	MNS 6230:2010
General requirements for assessment of soil erosion and degradation of vegetation cover in pasture lands	MNS 5546:2005
Pit latrine and sewage pit. Technical requirements	MNS 5924:2015
Passages for wild ungulates altogether highways and railways in steppe and Gobi areas. General requirements	MNS 6515:2015
Water quality. Maximum limit of substance contaminating the ground	MNS 6148:2010
Occupational health and safety	
Occupational safety and health. Requirement for method of determination of toxic substances concentration in the air of working zone	MNS 4991:2000
Occupational safety and health. General requirements for lead content in workplace air and the workplace	MNS 5803:2007
Occupational safety and operational security signs. Color of safety signs	MNS 4643:1998
Occupational safety and health. Vibration. Requirement for general safety	MNS 4994:2000
Occupational safety and health. Label and marking of toxic and hazardous chemicals	MNS 5029:2011
General safety requirements for loading and unloading	MNS 5079:2001
Occupational safety. Industrial hygiene. Hygiene protection areas norm, general requirements	MNS 5105:200
Occupational safety. Industrial hygiene. Electric safety. Protective conductive earth, neutralling	MNS 5146:2002
Occupational safety and health. Fire safety of electricity. General requirements	MNS 5390:2004
Safety of machinery. General requirements	MNS 4930:2000
Organization of a training. Basic rules	MNS 4969:2000
Occupational safety. Color of safety signs	MNS 4643:1998
Occupational safety and health. Vibration. Requirement for general safety	MNS 4994:2000
Device and method for protection from noise	MNS 0012.4.005:1985
General requirements for the measurements of noise	MNS 5003:2000
Occupational safety and health. Noise. Requirements for general safety	MNS 5002:2000
Personal protective equipment. Types and general requirements	MNS 4931:2000
Hearing protection equipment (ear plug, ear muff). General technical requirements	MNS 5388:2004
Eye protection equipment-Goggles	MNS 5389:2004

Name of the standards	Codes
Head protection equipment-Hard hat	MNS 5621:2006
Safety gloves. General requirements	MNS 5622:2011
Foot protection equipment. Safety boots	MNS 5623:2006
General requirements for transportation of domestic waste	MNS 5344:2011
Fire safety of petroleum products. General requirements	MNS 5282:2003
Protection against fire. Fire protection instrument for building. Technical requirements	MNS 5566:2020
Fire safety. General requirements	MNS 4244:1994
Petroleum, petroleum product. Packaging, labelling and transportation	MNS 3629:1983
Use of road signage, traffic light, protective bracket, and direction signs	MNS 4596:2014
Transportation of construction materials in pieces and bulk	MNS 5645:2006

2.1.2 National Legislation Related to the EIA

The parliament passed law on development policy and planning and its management in May 7, 2020 to ensure sustainability and consistency of development policy making and planning process of Mongolia, establish underlying principles development policy and planning nationwide, develop, plan and effectively implement development policy, carry out monitoring and evaluation, inform, build integrated and clear system, define rights and roles of stakeholders in policy making, and planning processes, ensure proper partnership of stakeholders in development policy making and planning, coordinate regulating relations related to types and forms of policy and planning documents and strengthen development policymaking and planning, its management and structure. This law regulates relations related to the development, adoption, planning, implementation, monitoring and evaluation and reporting of the development policies of Mongolia, establishment of an integrated system of development policy and planning, and management. According to the law, vision 2050 will be the long-term policy plan and 7 mid-term development target plans shall be developed. All developing projects are reflected in the long-term and mid-term policy documents. For the cumulative impact assessment, there are 2 foreseen projects considered that are reflected in the above-mentioned policy docs.

The project will entirely operate within the Mongolian national laws as identified in Table 2-1 and that specify environmental and social legislations. Mongolia has enacted a comprehensive policy and legal framework for environmental assessment and management. It has policies, legislation, and strategies in place to manage the protected estate, to satisfy its international obligations, and to protect the quality of the environment for the health and well-being of its citizens.

The Law on Environmental Impact assessment (EIA) was adopted by Mongolian parliament in 1998 and it was amended to allow accession in 2012. It aims to protect the environment by preventing any damage caused by human activities and natural resources use and minimizing significant adverse impacts on the environment. In addition, the core regulations of the law include assessing environmental impacts of development projects and making a decision for their implementation and regulating relevant stakeholder participation.

As described rules of the law, the terminology of environmental assessment consists of the following assessments:

- Strategic environmental assessment;
- Cumulative impact assessment
- Environmental impact assessment;
- Baseline environmental assessment

According to Mongolian law on EIA, the project proponents must submit a baseline report together with project design and approved feasibility study for Screening before the project implementation by state administrative central organization in charge of nature and environment. The experts shall conduct the screening and make one of the decisions; to reject the project, to accept the project and to require DEIA[9] (see Figure 2-1).

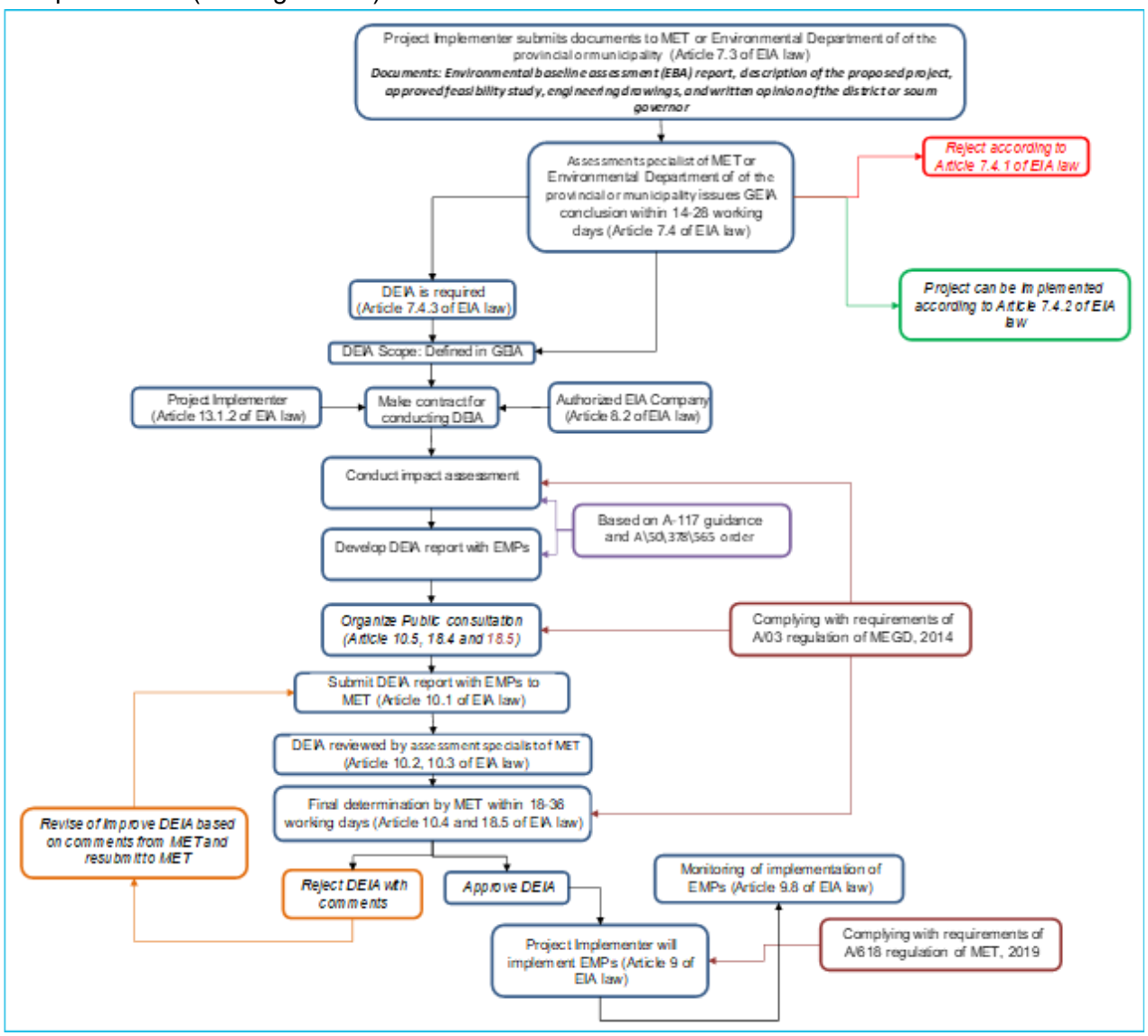


Figure 2-1 Flowchart of EIA Process in Mongolia

DEIA should be conducted by a licensed entity in case of a decision made to require DEIA. There is other important core regulations in EIA were issued in 2013 and 2014 to strengthen the EIA implementation:

- Guideline on environmental impact assessment
- Regulation on developing strategic and cumulative impacts
- Regulation on ensuring public participation for the EIA
- As described on the guideline of EIA process, there are certain environmental aspects and methodologies that could be applied to GEIA and DEIA implementation.

[9] Byambakhuu. 2022. Review of Environmental Impact Assessment System: Comparative Study of International Environmental Impact Assessment; Mongolian Environmental Impact Assessment, its Implementation, and Related Improvement Recommendations. UNDP-SEPA project.

2.1.3 National Policy Framework Related to the Project Framework

The Technical and Economic Feasibility Study for proposed Project has been developed based on the following legal and policy documents. Herein[10],

- Government Action Program of Mongolia for 2024-2028
- Resolution of the Government of Mongolia from the Meeting on March 27, 2024, Item 12 - Document on the Updated General Development Plan for Ulaanbaatar until 2020 and Development Trends until 2030, approved by the State Great Khural Resolution No. 23 of 2013
- "Vision 2050" Long-term Development Policy of Mongolia
    - Section 9.2.6: "Fully electrify public transportation to reduce greenhouse gas emissions in the transportation sector"
    - Section 9.3.12: "Introduce multi-modal and intelligent public transportation"
    - Section 9.3.13: "Implement high-capacity passenger transportation along corridors with high passenger flow"
    - Sections 9.3.20 and 9.3.31: "Introduce high-capacity transportation connecting satellite cities based on passenger flow
- Ulaanbaatar City Development Concept until 2040, supported by the Government of Mongolia in Meeting No. 35 of 2020
    - Section 4.3.2: "Develop balanced multi-modal transportation"
    - Section 4.4.6: "Design and implement a development model based on public transportation axes".
- The document on the Updated General Development Plan for Ulaanbaatar until 2020 and Development Trends until 2030, approved by the State Great Khural Resolution No. 23 of February 8, 2013, and the Implementation Action Plan for the same document approved by Government Resolution No. 174 of March 28, 2016, includes Section 2.3.1 stipulating: "Increase public transportation types and improve their coordination".
- Attachment 1 to the State Great Khural Resolution No. 23 of August 28, 2020, on the Main Directions for Mongolia's Development for 2021-2025, Section 9.3.4 stipulates that multi-modal and intelligent public transportation shall be introduced into service, ensuring passenger hygiene and safety, with public transportation stops. Accordingly, the Capital City Citizens' Representative Khural incorporated a provision in Section 9.21.3 of the Five-Year Development Main Directions for 2021-2025 to expand multi-modal and intelligent passenger transportation services, which was approved by Resolution No. 02/10 on December 4, 2020.
- In the medium and long-term master plan for the capital city's road network, the implementation plan for improving public transportation services includes 11 measures, such as introducing high-capacity, environmentally friendly public transportation systems, supporting a unified transportation policy, and optimizing public transportation networks, routes, and stop planning. Within this framework, the "National Committee for Ensuring Urban-Rural Development Balance, Reducing Centralization, and Decreasing Road Congestion" was established by Government Resolution No. 27 of January 25, 2017. As part of developing and implementing a national program with phased measures, the government emphasized that modernizing Ulaanbaatar's public transportation and introducing high-capacity public transportation would significantly reduce urban road traffic load. During the expanded government meeting on May 19, 2021, the government made a decision to provide annual funding to resolve the critical issues facing Ulaanbaatar, including INTRODUCTION I-15 challenges, specifically road congestion, expanding main and auxiliary roads and crossings, and addressing the urgent need for public transportation fleet renewal.
- At the Government of Mongolia meeting on August 25, 2021, a comprehensive plan was discussed to address Ulaanbaatar's traffic congestion and enhance public transportation quality and accessibility. The government resolved to implement a project for introducing high-capacity, innovative transportation vehicles, specifically a light rail system with an

[10] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 18

elevated guideway. Subsequently, during the meeting on August 31, 2021, the government instructed the Capital City Mayor to develop a preliminary feasibility study for this transportation project.

- Pursuant to the State Great Khural Resolution No. 106 of December 30, 2021, on the "New Revival Policy", the Urban and Rural Revival section stipulates improving the quality and standards of public transportation in Ulaanbaatar by introducing high-capacity new transportation vehicles, expanding and modernizing primary and main road networks and road infrastructure, establishing multi-level intersections to increase accessibility and reduce road congestion. In the first-stage implementation program of the "New Revival Policy", Section 4.1.3 specifically outlines improving public transportation quality and standards, increasing accessibility, and introducing high-capacity public transportation technologies. The development project list includes the "Urban Public Transportation Renewal and Introduction of High-Capacity New Public Transportation Services with Elevated Guideway Infrastructure" project, aimed at reducing Ulaanbaatar's traffic congestion.
- Directive No. A/1370 issued by the Governor of the Capital City dated November 15, 2024
- Technical Assignment No. 240101073 issued by the Capital City Road Development Agency dated December 09, 2024
- Technical Assignment No. 2501010240 issued by the Capital City Road Development Agency dated February 03, 2025
- Architectural Planning Assignment for Roads and Road Facilities No. 2025/00-214 issued by the Chief Architect of the Capital City dated February 27, 2025

2.2 EBRD's Environmental and Social Policy and Performance Requirements

The EBRD defines ten PRs to apply ESF and central to the PRs is the application of the mitigation hierarchy and good international practice to avoid, minimize, reduce or mitigate the adverse environmental and social risks and impacts of the proposed Projects. The PRs constitute the requirements relating to the identification and assessment of environmental and social risks and impacts associated with project activities. The EBRD PRs 1-10 and their application in the propsed Project are reflected in the Table 2-3.

International Framework for Social Management Plan

The Contractor and its subcontractors are recommended to comply with a set of core environmental and social standards:

- The Universal Declaration of Human Rights, 1948
- The Convention on the Elimination of All Forms of Discrimination Against Women, 1979
- ILO Convention No. 29 (1930) and 105, Forced and Bonded Labor, 1957
- ILO Convention No. 87, Freedom of Association and Right to Organize, 1948
- ILO Convention No. 98, Right to Organize and Collective Bargaining, 1949
- ILO Convention No. 100, Equal Remuneration, 1951
- ILO Convention No. 103, Maternity Protection Conventions, 1952
- ILO Convention No. 111, Discrimination in Respect of Employment and Occupation, 1958
- ILO Convention No. 138, Minimum Age, 1973
- ILO Convention No. 155, Occupational Safety and Health, 1981
- ILO Convention No. 159, Vocational Rehabilitation and Employment (Disabled Persons)), 1983
- ILO Convention No. 182, Worst Forms of Child Labor, 1999
- ILO Convention No. 190, Violence and Harassment, 2019
- IFC, EBRD guidance note - Workers' accommodation: processes and standards (2009)
- This Guidance note is aimed at guiding applying appropriate standards to the construction and operation of the workers' accommodation

Table 2-3 EBRD requirements

EBRD Performance Requirement	Relevant	Description	EBRD's Requirements regarding the Project
PR1: Assessment and Management of Environmental and Social Risks and Impacts	Yes	The PR1 includes the importance of an integrated assessment to identify the environmental and social risks and impacts associated with projects and the client's management of environmental and social performance throughout the life of the project. Also, this PR1 outlines the responsibilities of the client in the process of assessing the potential environmental and social risks and impacts associated with the project, and developing and implementing procedures for managing and monitoring these risks and impacts. Contractor identifies and assess environmental and social risks and impacts of the project and adopt a mitigation hierarchy approach to address environmental and social risks and impacts from project activities on workers, affected communities, and the environment. Engagement during identifying and assessing environmental and social risks and impacts of the project is critical process.	Assessment: • The Environmental Baseline report has been developed by certified consulting company. • According to Article 7.3 of Mongolian EIA law, general environmental impact assessment (GEIA) conclusions has been issiued on 2025.10.02 with order number 10/4989 based on approved Feasibility study report, Environmental Baseline report and official letter from local governments. Detalied environmental impact assessment has been required to conduct based on GEIA conclusions.
PR2: Labour and Working Conditions	Yes	The PR2 ensures fair treatment, non-discrimination, and equal opportunity for workers while promoting safe and healthy working environments. It mandates compliance with national labour laws and key International Labour Organization (ILO) conventions, including those addressing forced labour, child labour, and workplace equality. It requires clients to establish sound worker-management relationships, uphold collective bargaining rights, and provide fair wages and benefits. Additionally, it emphasizes risk assessments in supply chains, ethical employment practices, and proper grievance mechanisms to protect workers' rights.	Labour and Working Conditions during the construction and operational phase will be covered by project implementer management system, which is mainly appropriate. Generic Labour management plan is provided in Appendix D. This plan must be updated later accordingly.
PR3: Resource Efficiency and Pollution Prevention and Control	Yes	The PR3 includes the nonhazardous and hazardous materials management. The contractor will avoid the generation of nonhazardous and hazardous waste. If waste generation cannot be avoided, the contractor will minimize the generation of waste, and reuse, recycle and	Waste management plan during the construction and operational phase will be covered by project implementer management system, which is mainly appropriate. Generic Waste management plan is provided in Appendix A. This plan must be updated later accordingly.

EBRD Performance Requirement	Relevant	Description	EBRD's Requirements regarding the Project
		recover waste in a manner that is safe for human health and the environment. In cases when waste cannot be reused, recycled or recovered, the contractor will treat or dispose of it in an environmentally sound and safe manner. This includes the appropriate control of emissions and residues resulting from the handling and processing of the waste material. If the generated waste is considered hazardous, the contractor will comply with existing requirements for management (including storage, transportation and disposal) of hazardous wastes including national legislation and EU substantive environmental standards. When waste disposal is transferred offsite and/or managed by third parties, the client will obtain chain of custody documentation to the final destination and will use contractors that are licensed by the relevant regulatory agencies. The client will maintain an appropriate duty of care with respect to waste management. The PR3 describes that a project-level approach to climate impacts and greenhouse emissions, resource management and pollution (such as noise, pollutants in the solid, liquid, contamination of environmental media: including soil, air and water) prevention and control. The PR3 includes the determination of the appropriate pollution prevention and control methods, technologies and practices ("techniques") to be applied to the project that are best suited to avoid or minimise adverse impacts on human health and the environment. Throughout the project lifecycle, pollution prevention and control techniques consistent with the mitigation hierarchy to be applied to minimise potential adverse impacts on human health and the environment while remaining technically and financially feasible and cost effective. This applies to the release of pollutants due to routine, non-routine or accidental circumstances.	
PR4: Health, Safety, and Security	Yes	The PR4 describes that, the contractor will prevent or reduce the potential for worker and project-affected community exposure to hazardous materials that may be released by the project by adopting the hierarchy of risk control.	Health, Safety, and Security issues during the construction and operational phase will be covered by project implementer management system, which is mainly appropriate. Emergency Preparedness and Response Plan should be prepared and

EBRD Performance Requirement	Relevant	Description	EBRD's Requirements regarding the Project
		Where there is a potential for workers and the project-affected community to be exposed to hazards, the client will exercise due care to manage their exposure by eliminating, substituting or isolating the condition or substance causing the hazards. Also, the Emergency Preparedness and Response Plan should be prepared and documented.	documented. Generic Emergency Preparedness and Response Plan is provided in Appendix B. This plan must be updated later accordingly.
PR5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Yes	Addresses land acquisition, involuntary resettlement, and economic displacement, aiming to minimize negative impacts on affected communities. It emphasizes fair compensation, livelihood restoration, and meaningful consultation with displaced persons to ensure their rights and well-being. PR5 encourages negotiated settlements over forced displacement and requires clients to implement resettlement plans that align with international human rights standards. Additionally, it mandates monitoring and grievance mechanisms to safeguard affected individuals and promote sustainable resettlement outcomes.	The construction acitivities require Land Acquisition, Involuntary Resettlement and Economic Displacement. The Resettlement Action Plan (RAP) must be prepared in line with EBRD's requirement PR5 and Mongolian relevant laws and regualtions. Resettlement framework is provided in Appendix B. This Resettlement framework can be base fore developing Resettlement Action Plan later accordingly.
PR6: Biodiversity Conservation and Sustainable Management of Living Natural Resources)	Yes	The PR6 describes that protect and conserve biodiversity using a precautionary approach; adopt the mitigation hierarchy in the design and implementation of projects with the aim of achieving no net loss, and where appropriate, a net gain of biodiversity; maintain ecosystem services; and promote good international practice in the sustainable management and use of living natural resources. The PR3 applies to situations where livelihood of affected communities, whose access to, or use of, biodiversity, ecosystem services and/or living natural resources may be affected by project activities.	The Tram alignment crosses an urban area with no natural territories in its vicinity. The impact on Biodiversity and Living Natural Resources is limited.
PR8: Cultural Heritage	Yes	It ensures that cultural heritage is identified, protected, and responsibly managed in projects it finances. It mandates clients to assess and mitigate any potential impacts on both tangible and intangible heritage while complying with national and international regulations. PR8 also requires stakeholder engagement to safeguard historically or culturally significant assets throughout the project lifecycle.	The Tram alignment crosses an urban area, therefore no direct impacts on culture heritage.

EBRD Performance Requirement	Relevant	Description	EBRD's Requirements regarding the Project
PR10: Information Disclosure and Stakeholder Engagement	Yes	The PR 10 focuses on information disclosure and stakeholder engagement, ensuring transparency and meaningful consultation throughout a project's lifecycle. It requires clients to provide timely, accessible, and culturally appropriate information to affected communities, enabling informed participation in decision-making. PR10 mandates the development of a Stakeholder Engagement Plan (SEP), outlining strategies for communication, grievance mechanisms, and ongoing dialogue. It emphasizes the importance of avoiding manipulation, coercion, or intimidation in stakeholder interactions, fostering trust and accountability.	For successful project implementation, it is important to properly identify stakeholders, determine their interests, influence, and responsibilities, and implement effective communication management to ensure their productive involvement. Local social media and TV news highlights the process of the Project preparation. Stakeholder Engagement Plan (See Appendix E) must be prepared during the detailed environmental impact assessment. To meet the environmental and social requirements and performance standards of EBRD the revelant reports should be disclosed to the public on a project implementer website.

3. Project Description

The purpose of the "Ulaanbaatar Tram Project from the General Archives to Sukhbaatar Square," which aims to introduce a multimodal public transport system from the Buyant-Ukhaa Complex to the Silk Road Complex and from the 120 Thousandth Intersection to Sukhbaatar Square, is to construct a Light Rail Transit (LRT) tram line within Ulaanbaatar's public transportation network. The project seeks to enhance accessibility to public transport, alleviate road congestion and traffic load, improve traffic management, and introduce new standards and culture to public transit services. It also aims to ensure safe and comfortable service for citizens. Furthermore, the project is aligned with Ulaanbaatar's general urban development plan, architectural and spatial planning strategies, and the city's current socio-economic conditions. It will take into consideration the existing state of road infrastructure and contribute to reducing traffic pressure across the city.

The project to implement a multimodal public transport system from Buyant-Ukhaa Complex to Torgonii Zam Complex and from 120 thousandthTH INTERSECTION TO SUKHBAATAR SQUARE is located within the territories of the 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 15th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, and 25th khoroos of Khan-Uul District, the 1st and 2nd khoroos of Sukhbaatar District, and the 3rd and 26th khoroos of Bayangol District. The project covers an area of 1272.83 hectares within a space that is 15.0 km long and 800 m wide, extending from the southern parking area of Sukhbaatar Square to the General Archives Authority.

The feasibility study and detailed design of the project were developed by the Urban Planning and Research Institute, based on Design Assignment No. 2023/09 approved by the Minister of Construction and Urban Development and the Governor of the Capital City/Mayor of Ulaanbaatar, as well as Consulting Service Contract No. NUBG 2023-A/492-3Y-02. General project information is presented in Table 3-1.

Table 3-1 Executive Summary of the Project

Project Information	
Project Client	Office of the Mayor of the Capital
Project Implementing Organization	Institute of Urban Planning and Research
Address of the Project Implementer	Ulaanbaatar city, Khan-Uul district, 4th khoroo, Artsatyn am, Khangarid Palace
Purpose of the Project	The project involves the construction of a Light Rail Transit (LRT) tram system within the public transportation network of Ulaanbaatar city. The objectives are to improve public transport accessibility, reduce road congestion, and enhance traffic management. Additionally, the project aims to establish new cultural and standard requirements for public transportation, provide services that ensure passenger comfort and safety, and align with Ulaanbaatar's master plan, architectural and spatial planning solutions, as well as socio-economic conditions. The project will also study and assess the current road conditions and seek to reduce traffic load accordingly.
Project Title	Light Rail Transit (LRT) from the General Archives to Sukhbaatar Square.

3.1 Rationale and Justification

The following challenges in implementing a high-capacity public transportation system (Metro) in Ulaanbaatar city, which aligns with the sustainable development concept, supports urban development and prosperity, and ensures safe and comfortable travel conditions for citizens, it is fundamental rationale for conducting this research. Herein:

- Ulaanbaatar has demonstrated significant population growth - from 560,600 in 1990 to 760,000 in 2000, 1,112,300 in 2010, and currently 1,640,000 inhabitants across 421,600 households in 2024, representing 47.6% of Mongolia's total population.
- Geographically, the city is situated along the Tuul River valley, enclosed by Bogdkhan Mountain to the south and Songino Khairkhan, Chingeltei, and Bayanzurkh mountains to the west, north, and east. Given its territorial and geographical location characteristics, it is a monocentric, linear city. Currently, of the city's 35,206 hectares of developed territory, 17,693.3 hectares are urbanized. The city is characterized by two primary settlement types: zones with centralized engineering infrastructure and partially serviced ger areas along the Tuul River valley.
- The Ulaanbaatar Urban Development Concept 2040 aims to transition from a single-center to a multi-center urban structure. The strategy focuses on decentralizing urban concentration, supporting and limiting urban development, defining development zones, and implementing public transportation development in alignment with urban planning policies.
- As of 2024, the city encompasses 584.6 kilometers of primary and auxiliary road networks, with most sections experiencing high traffic loads, poor road conditions, and significant infrastructure deterioration. The predominant portion of the city's road network (approximately 75%) is located within the developed urban territory.
- Current vehicle registration stands at 679,000, nearly tripling the road network's designed capacity. Public transportation ridership decreases as the number of registered private vehicles increases.
- Urban congestion and overlapping public transportation route networks result in public transportation vehicles average travel speed is between 8-15 kilometers per hour[11].

3.2 Regulatory context

The Technical and Economic Feasibility Study for introducing multi-modal public transportation from Buyant Ukhaa Complex to Torgonii Zam Complex, from the 120 thousandth Intersection to Sukhbaatar Square has been developed based on the following legal documents. Herein[12],

- Government Action Program of Mongolia for 2024-2028
- Resolution of the Government of Mongolia from the Meeting on March 27, 2024, Item 12 - Document on the Updated General Development Plan for Ulaanbaatar until 2020 and Development Trends until 2030, approved by the State Great Khural Resolution No. 23 of 2013
- "Vision 2050" Long-term Development Policy of Mongolia
    - Section 9.2.6: "Fully electrify public transportation to reduce greenhouse gas emissions in the transportation sector"
    - Section 9.3.12: "Introduce multi-modal and intelligent public transportation"
    - Section 9.3.13: "Implement high-capacity passenger transportation along corridors with high passenger flow"
    - Sections 9.3.20 and 9.3.31: "Introduce high-capacity transportation connecting satellite cities based on passenger flow
- Ulaanbaatar City Development Concept until 2040, supported by the Government of Mongolia in Meeting No. 35 of 2020
    - Section 4.3.2: "Develop balanced multi-modal transportation"
    - Section 4.4.6: "Design and implement a development model based on public transportation axes".
- The document on the Updated General Development Plan for Ulaanbaatar until 2020 and Development Trends until 2030, approved by the State Great Khural Resolution No. 23 of February 8, 2013, and the Implementation Action Plan for the same document approved by

[11] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 17
[12] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 18

Government Resolution No. 174 of March 28, 2016, includes Section 2.3.1 stipulating: "Increase public transportation types and improve their coordination".

- Attachment 1 to the State Great Khural Resolution No. 23 of August 28, 2020, on the Main Directions for Mongolia's Development for 2021-2025, Section 9.3.4 stipulates that multi-modal and intelligent public transportation shall be introduced into service, ensuring passenger hygiene and safety, with public transportation stops. Accordingly, the Capital City Citizens' Representative Khural incorporated a provision in Section 9.21.3 of the Five-Year Development Main Directions for 2021-2025 to expand multi-modal and intelligent passenger transportation services, which was approved by Resolution No. 02/10 on December 4, 2020.
- In the medium and long-term master plan for the capital city's road network, the implementation plan for improving public transportation services includes 11 measures, such as introducing high-capacity, environmentally friendly public transportation systems, supporting a unified transportation policy, and optimizing public transportation networks, routes, and stop planning. Within this framework, the "National Committee for Ensuring Urban-Rural Development Balance, Reducing Centralization, and Decreasing Road Congestion" was established by Government Resolution No. 27 of January 25, 2017. As part of developing and implementing a national program with phased measures, the government emphasized that modernizing Ulaanbaatar's public transportation and introducing high-capacity public transportation would significantly reduce urban road traffic load. During the expanded government meeting on May 19, 2021, the government made a decision to provide annual funding to resolve the critical issues facing Ulaanbaatar, including INTRODUCTION I-15 challenges, specifically road congestion, expanding main and auxiliary roads and crossings, and addressing the urgent need for public transportation fleet renewal.
- At the Government of Mongolia meeting on August 25, 2021, a comprehensive plan was discussed to address Ulaanbaatar's traffic congestion and enhance public transportation quality and accessibility. The government resolved to implement a project for introducing high-capacity, innovative transportation vehicles, specifically a light rail system with an elevated guideway. Subsequently, during the meeting on August 31, 2021, the government instructed the Capital City Mayor to develop a preliminary feasibility study for this transportation project.
- Pursuant to the State Great Khural Resolution No. 106 of December 30, 2021, on the "New Revival Policy", the Urban and Rural Revival section stipulates improving the quality and standards of public transportation in Ulaanbaatar by introducing high-capacity new transportation vehicles, expanding and modernizing primary and main road networks and road infrastructure, establishing multi-level intersections to increase accessibility and reduce road congestion. In the first-stage implementation program of the "New Revival Policy", Section 4.1.3 specifically outlines improving public transportation quality and standards, increasing accessibility, and introducing high-capacity public transportation technologies. The development project list includes the "Urban Public Transportation Renewal and Introduction of High-Capacity New Public Transportation Services with Elevated Guideway Infrastructure" project, aimed at reducing Ulaanbaatar's traffic congestion.
- Directive No. A/1370 issued by the Governor of the Capital City dated November 15, 2024
- Technical Assignment No. 240101073 issued by the Capital City Road Development Agency dated December 09, 2024
- Technical Assignment No. 2501010240 issued by the Capital City Road Development Agency dated February 03, 2025
- Architectural Planning Assignment for Roads and Road Facilities No. 2025/00-214 issued by the Chief Architect of the Capital City dated February 27, 2025

3.3 Project objectives

The purpose of this technical and economic feasibility study is to analyze and calculate the requirements and conditions for implementing a light rail system in the public transportation service of Ulaanbaatar city, to determine to create an overview of required investment costs, to define the implementation process in phases, and to propose planning solutions by conducting baseline research for developing a preliminary general plan.

The objective of the project is to:

- To construct a Light Rail Transit (LRT) tram system in Ulaanbaatar city's public transportation network with the aim of improving public transport accessibility, improving urban accessibility, reducing traffic congestion, improving traffic organization, establishing new cultural standards and requirements for public transportation, providing services that ensure citizens' comfort and safety, and aligning with Ulaanbaatar city's master plan, architectural and spatial planning solutions, and socio-economic conditions, while studying and determining road conditions to reduce traffic load.
- To construct a Light Rail Transit (LRT) tram system in Ulaanbaatar city's public transportation network with the aim of improving public transport accessibility, improving urban accessibility, reducing traffic congestion, improving traffic organization, establishing new cultural standards and requirements for public transportation, providing services that ensure citizens' comfort and safety, and aligning with Ulaanbaatar city's master plan, architectural and spatial planning solutions, and socio-economic conditions, while studying and determining road conditions to reduce traffic load[13].

The fundamental issues being addressed to achieve this are:

- To identify environmental constraints and limitations necessary for planning,
- To study and determine on-site conditions through engineering geology, geodesy, and environmental assessment,
- To establish construction areas based on land capacity and vehicular traffic demand requirements,
- To identify current traffic congestion conditions in Ulaanbaatar city and determine congestion reduction conditions following implementation of the planned system,
- To determine throughput capacity, road expansion conditions, and their respective capacities.
- To develop the light rail network to connect and advance urban centers, sub-centers, and primary community micro-centers, while supporting and developing sustainable urban transport with modern engineering solutions for corridors and stations along the network. As a result, high-quality technical solutions for pedestrian and bicycle infrastructure will be proposed to ensure that corridor-based business services, pedestrians, and cyclists can safely, reliably, and comfortably access and exit the light rail transit (LRT) stations.
- To develop implementation phase plans and financing solutions[14]

3.4 Scope of project

The project to implement a multimodal public transport system from Buyant-Ukhaa Complex to Torgonii Zam Complex and from 120 thousandthTH INTERSECTION TO SUKHBAATAR SQUARE is located within the territories of the 1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 15th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, and 25th khoroos of Khan-Uul District, the 1st and 2nd khoroos of Sukhbaatar District, and the 3rd and 26th khoroos of Bayangol District. The project covers an area of 1272.83 hectares within a space that is 15.0 km long and 800 m wide, extending from the southern parking area of Sukhbaatar Square to the General Archives Authority[15].

[13] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 20
[14] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 20
[15] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 21

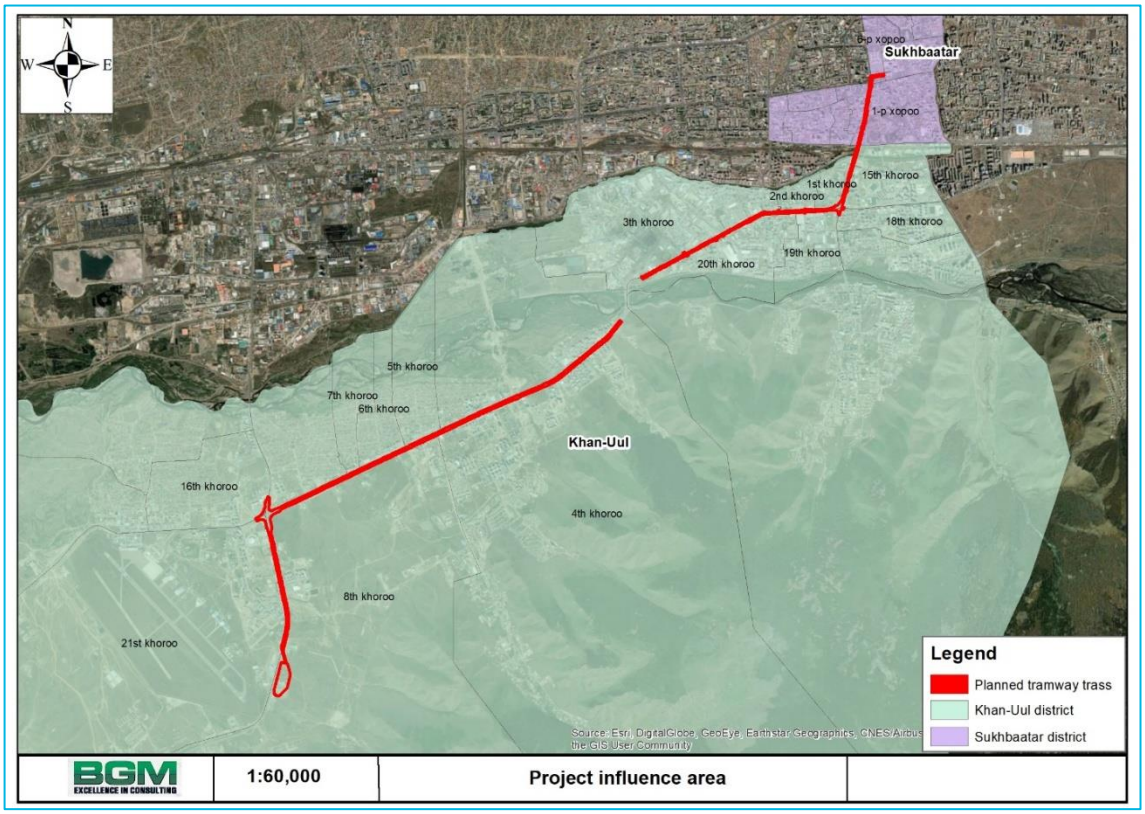


Figure 3-1 Districts and Khoroo Affected by the Project

3.5 Planning Concept

3.5.1 Tramway line planning solution

Urban Development Plan: The optimization and improvement of the city's public transportation network is designed to ensure comfortable travel conditions for residents and citizens, while supporting sustainable economic growth and environmental stability of the city. The planning of the city's public transportation network has been developed based on the city's street network planning solutions through 2040. During the planning period, reaching the 2040 level, by implementing phased upgrades to the public transportation network and public passenger vehicle fleet throughout Ulaanbaatar, daily passenger circulation will reach 1.2 million, increasing capacity by 50% from the current level.

The city's public transportation routes will be planned and developed along the horizontal and vertical axes of the city's street network, eliminating current public transportation route overlaps and reducing travel time by 2-2.5 times. During the planning period, the plan includes 42.23 km of metro, 10 km of LRT, 61.15 km of BRT, and 7.1 km of aerial cable transportation network. With the addition of tram lines, these three routes are expected to handle 60% of public transport trips, and the average speed of public transportation is projected to reach 30 km/h. This scope has been reflected in the project planning. Within the planning framework, considering the spatial limitations and current traffic congestion, the main objective is to reduce the time citizens spend on transportation by establishing an independent public transport system that enables fast and efficient travel[16].

The planned tram line layout is shown in Figure 3-2.

[16] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 141

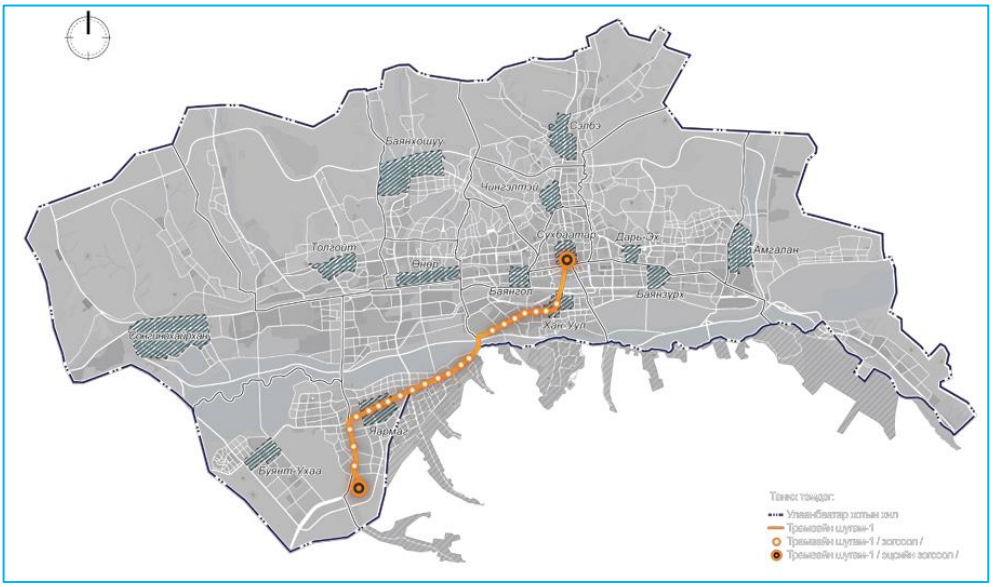
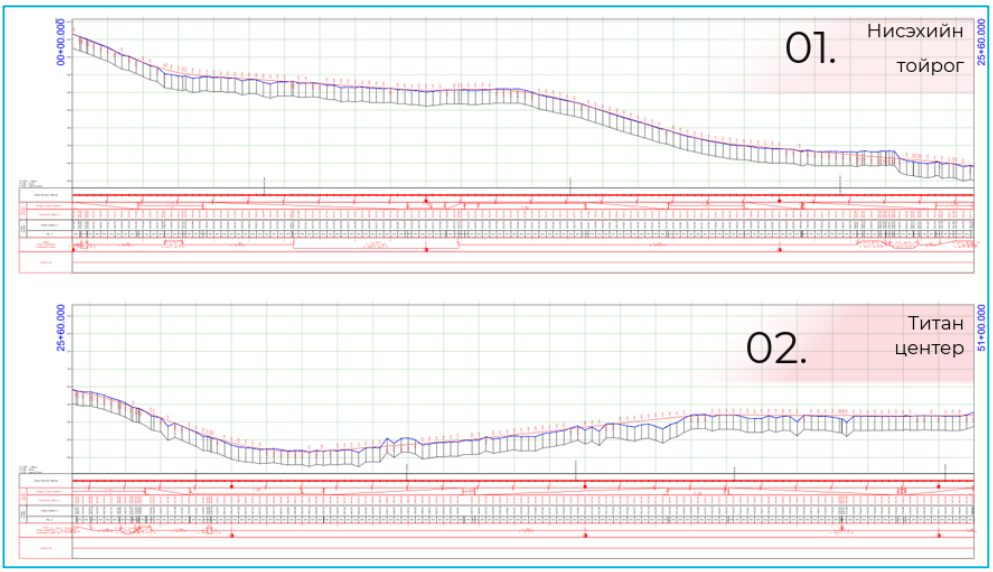
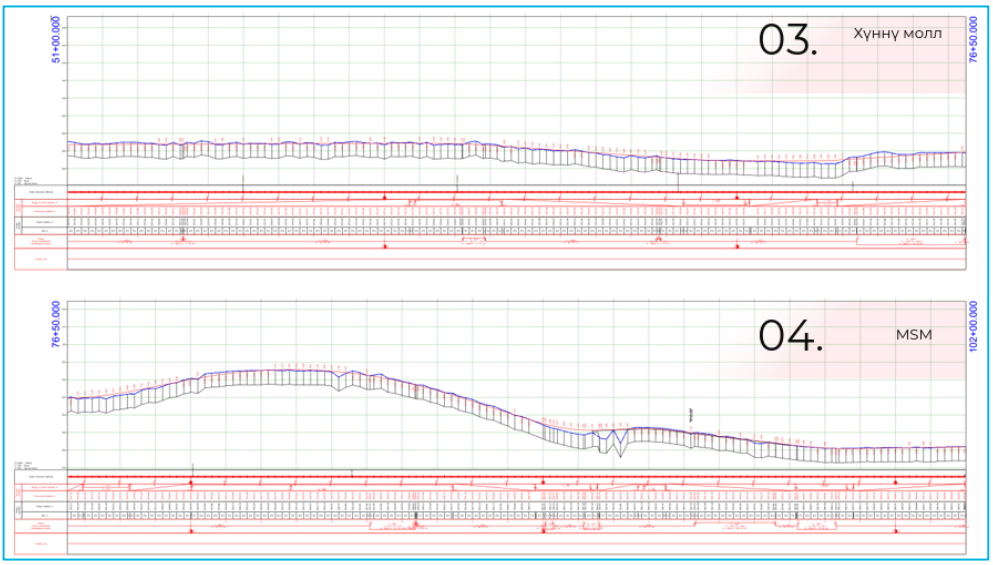
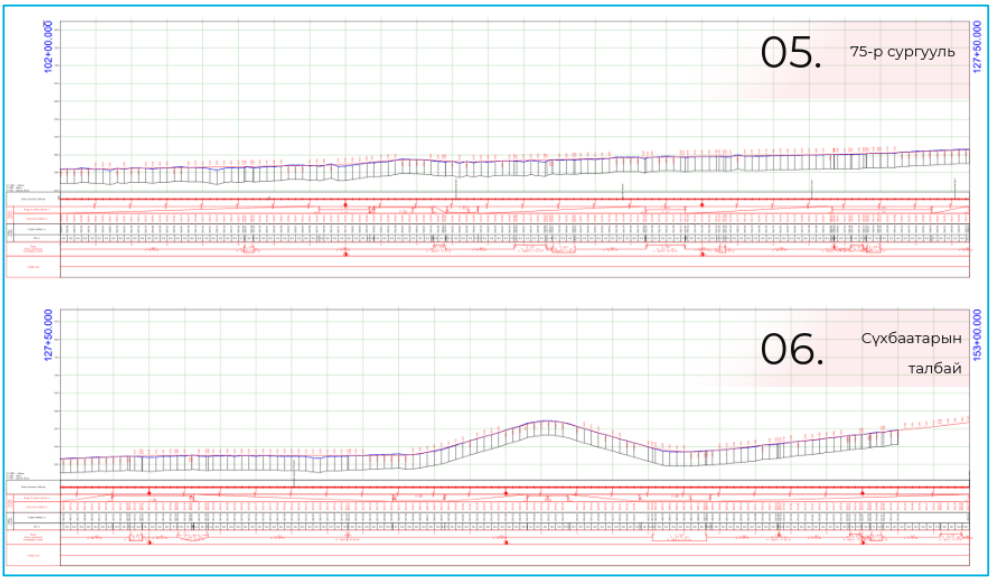


Figure 3-2 Planned Tram Line







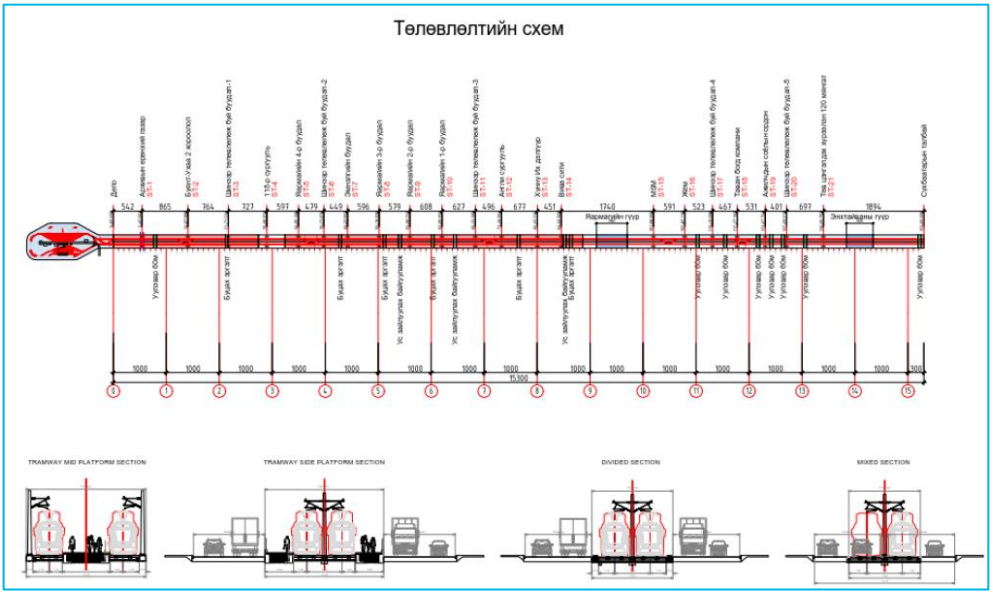


Figure 3-3 Planning Scheme

3.5.1.1 Types of cross-sections of along the tramway

1. Cross-section type of the section along Naadamchid Road with a central median. Width: 47.9 meters[17].

[17] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 150

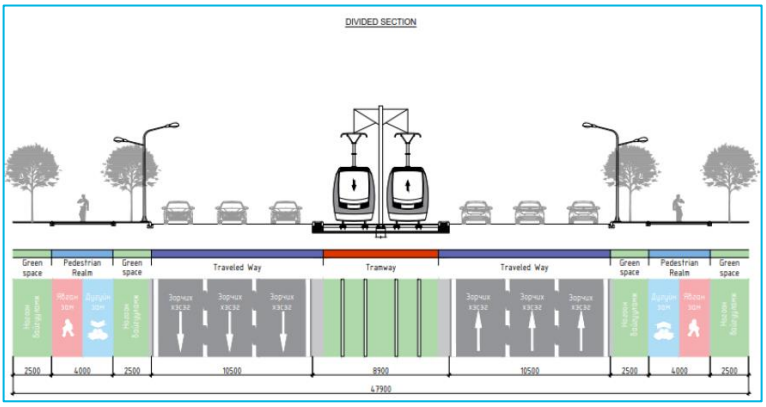


Figure 3-4 Standard Cross-Section / Width: 47.9 meters /

2. Width: 52.575 meters.

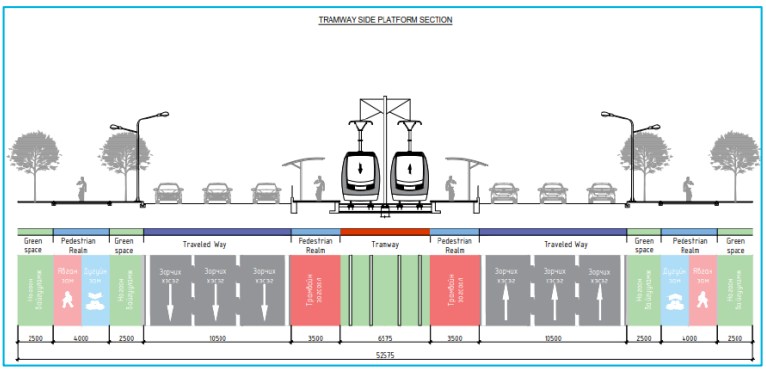


Figure 3-5 Cross-Section with Tramway

3. Type of at-grade paved cross-section intersecting with vehicular traffic along Naadamchid Road (including U-turns and intersections). Width: 41.8 meters [18].

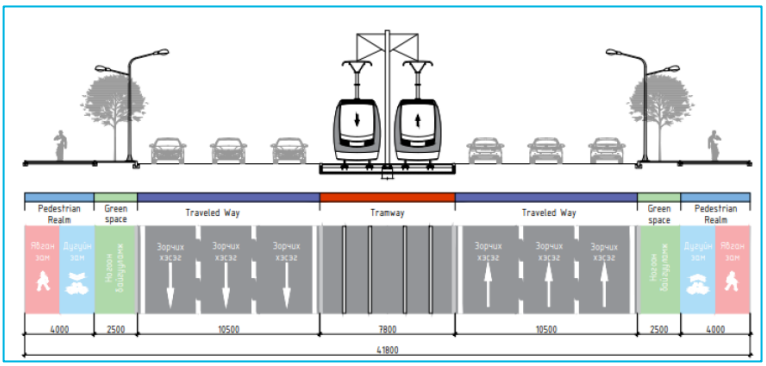


Figure 3-6 Combined Cross-Section with Road – 1

4. Cross-section type along the six-lane roadway without a median strip from Yarmag Bridge to the 120 Myngat intersection. Width: 34.8 meters.

[18] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 150

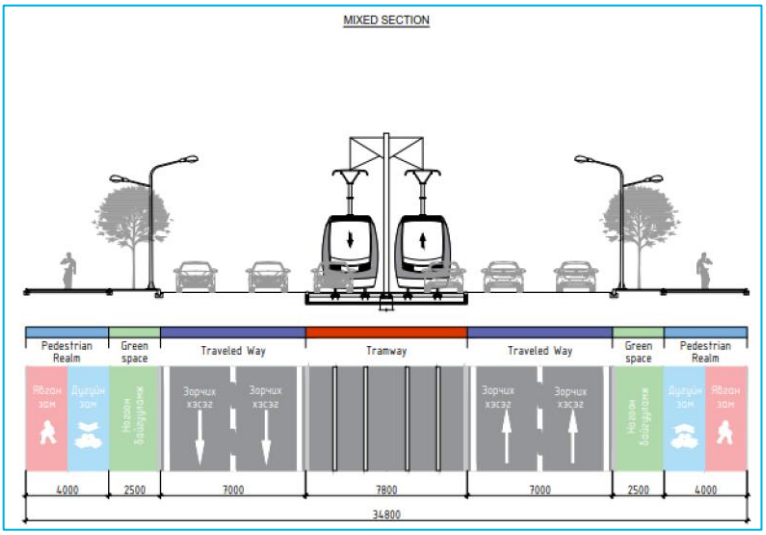
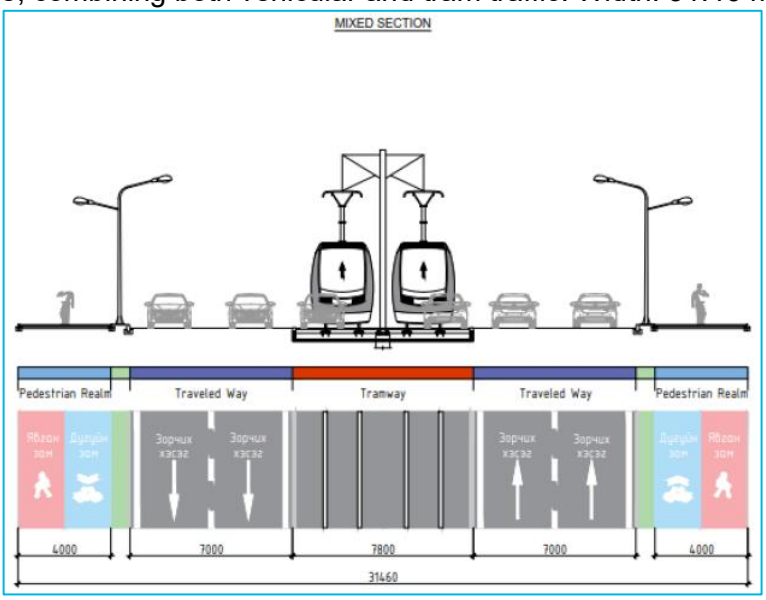


Figure 3-7 Combined Cross-Section with Road – 2

1. Cross-section type planned for the narrow space between the 120 Myngat intersection and Sukhbaatar Square, combining both vehicular and tram traffic. Width: 31.46 meters[19].



Conclusion: These cross-sections along the travel route are integrated planning solutions aimed at managing urban traffic loads and organizing the flow of various types of vehicles. These cross-sections are particularly important for meeting the following fundamental objectives:

Optimal Regulation of Vehicle Traffic Flow:

The widths of travel sections have been determined according to standards, with measures included to increase flow capacity in high-density traffic areas. The high-capacity public transport vehicle, the tram, has been specifically planned for introduction, with traffic organization solutions developed to avoid impeding the flow of travel sections. By planning cross-sections with tram stops, attention has been paid to passenger safety and creating a comfortable waiting environment. Pedestrian paths and bicycle lanes have been specifically planned in all types of cross-sections, ensuring safe and comfortable travel conditions for citizens. Green spaces have been added along pedestrian and bicycle paths, enhancing environmental comfort.

[19] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 151

Combined Organization of Multiple Modes: Planning that coordinates various types of traffic flows has become a solution that positively impacts citizens' living environment and urban planning. These cross-sections play an important role not only in organizing road traffic but also in improving urban quality of life and environmental conditions. This planning along Naadamchid Road can be concluded to be aligned with the objectives of Ulaanbaatar city's 2040 Development Master Plan and meets the needs and requirements of citizens[20],

The locations of stops were determined by considering existing bus stops along the project line, designated car parking, and external parking areas of commercial services and public buildings in the surrounding area. There are a total of 23 stations in the planning area[21].

3.5.2 Public transportation stop planning

The locations of existing bus stops, designated vehicle parking areas, as well as nearby commercial services and public building parking facilities along the project route were collectively examined to determine the optimal placement of stops. According to Mongolian Standard MNS 5879-2012 "Public Transport Route Stops. Classification. Technical Requirements" section 7.5, "The distance between route stops shall be 400-600 meters within the city, and determined based on road conditions and settlement structure outside the city." Also, the "Urban Planning and Construction Norms and Regulations" (BNbD 30-01-04) section 6.28 states, "The walking distance to public passenger transport stops shall be planned at not less than 300 meters" [22].

The planned alignment includes 23 designated public transport stops.

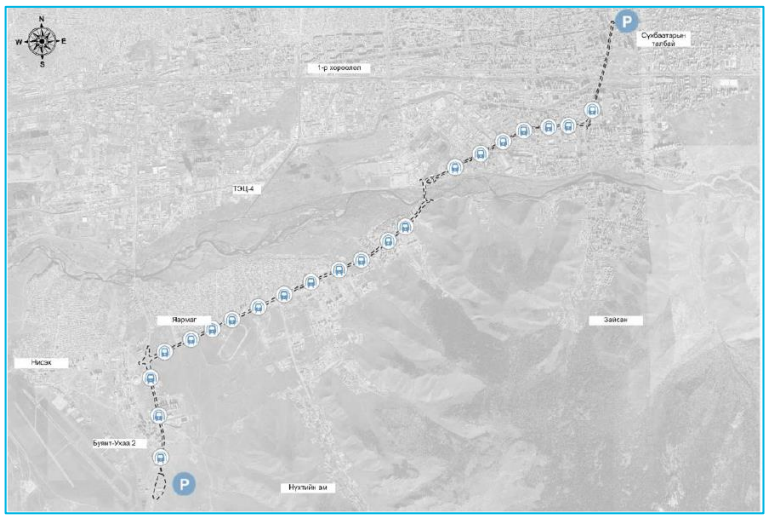


Figure 3-8 Public Transportation stop planning along the Planning Route

In developing the planning solution, two alternatives were considered for stops, with each stop designed to be 3m wide and 60m long.

The placement of each of the 23 planned stops will depend on specific location characteristics, road space, traffic intensity, and pedestrian access. The appropriate design variant from the cross-sections will be selected for each location, with detailed planning to occur during the design documentation phase[23].

[21] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 154
[22] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 158
[23] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 158

1. Stops Located on Both Sides

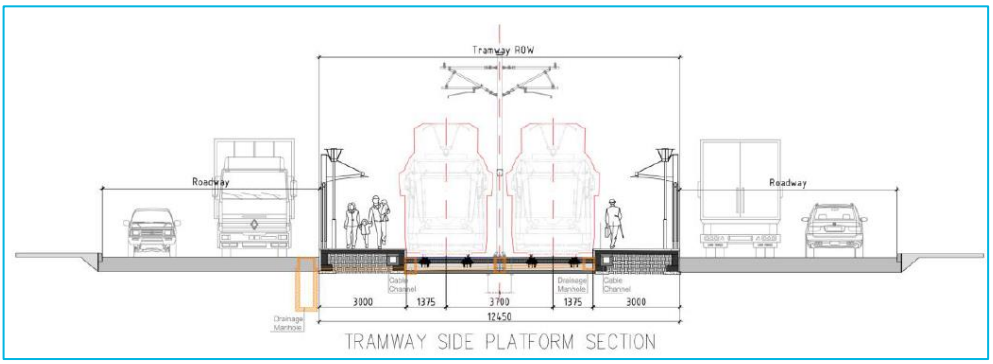


Figure 3-9 Visual Representation of stops on Both Sides

2. Center-Located Stops

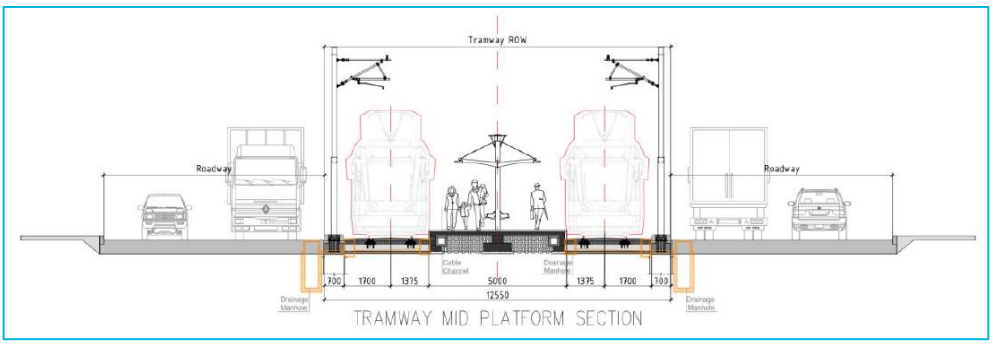


Figure 3-10 Visual Representation of Center-located stops

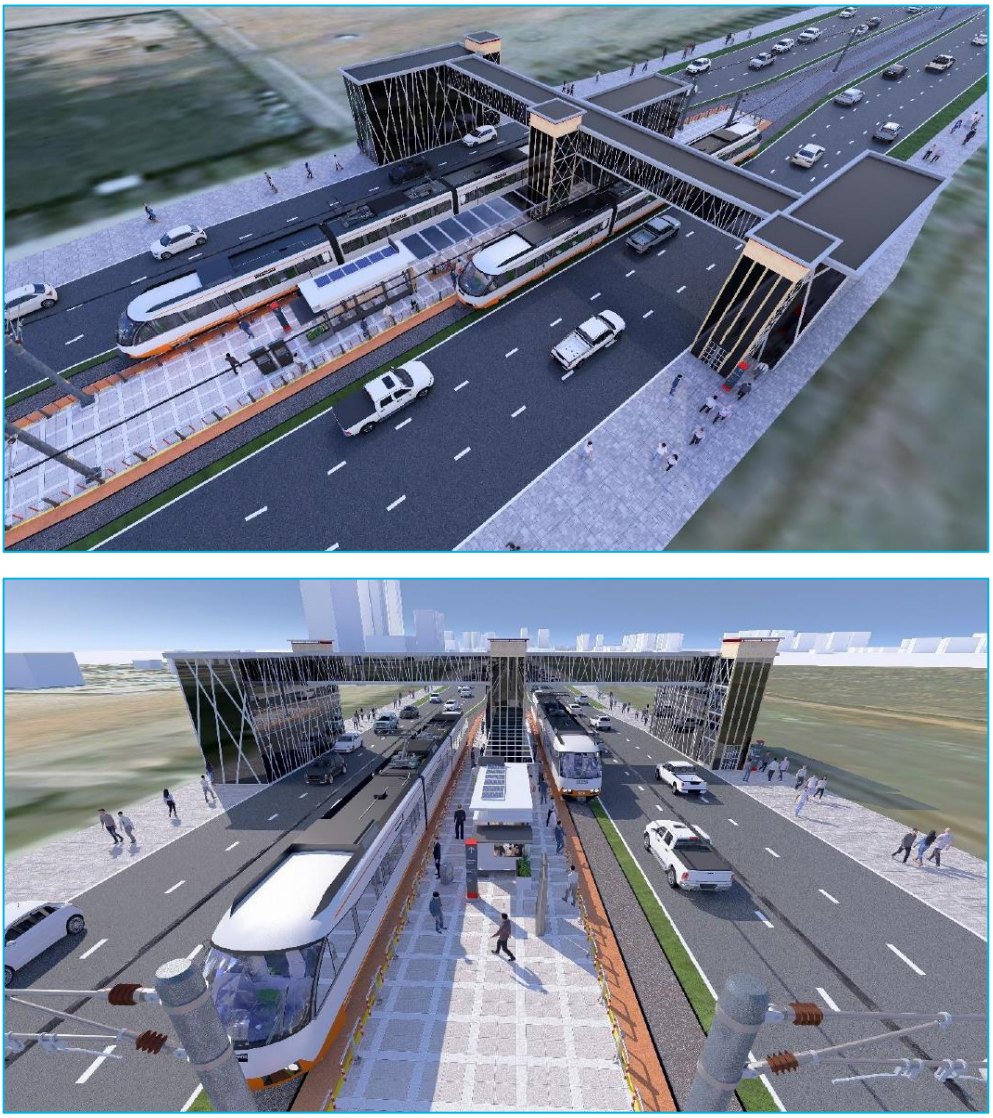


Figure 3-11 Public-Private Partnership Stop Alternative

There is potential to build 1-2 stops with service facilities on each line through public-private partnerships[24].

3.5.3 Tram traffic organization

The tram project will not only address central city issues but can also be expanded to cover suburban areas. Most importantly, the network can be easily expanded until 2050-2060, providing a complete solution for future city traffic. Ulaanbaatar's implementation of this new public transport system will serve as a good example for cities like Darkhan and Erdenet to introduce tram systems.

Tram capacity is 230-260 people, with the ability to increase train frequency and reduce intervals during peak hours. It will enable travel from any city outskirts to the center within 30 minutes.

Tram passenger transport offers numerous advantages.

- Electric power source means no noise, air pollution, or greenhouse gas emissions
- Being at the same level as roads results in lower construction costs, no intersection obstacles, and easy integration with bus networks, pedestrian and bicycle paths

[24] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 161

- Passenger capacity can be increased according to demand, with capability to carry up to 400 passengers at once
- Lower maintenance costs compared to other transport services[25].

As trams are new to Mongolia, they will operate with minimal risk when running along the green median strip of Yarmag Road, separated from vehicular and pedestrian traffic. However, when entering the city center from Peace Bridge to Sukhbaatar Square, trams will run at the same level as cars, necessitating updates to road traffic regulations and driver education campaigns coinciding with the system's launch.

Safety in tram passenger transport operation is the most critical aspect, requiring human resource training, educational programs, research, and selection of advanced technological solutions. Modern tram manufacturing has incorporated new technologies with significant improvements in passenger comfort and safety. Given the current intensity of Ulaanbaatar's road traffic, the probability of accidents such as collisions in level-grade sections with cars is high, making regulations, unified management, and driver education campaigns crucially important.

While a car traveling at 50 km/h has a stopping distance of 15 meters, a tram at the same speed requires three times that distance 45 meters to stop.

Ensuring tram transport safety is of paramount importance to all road users and must be prioritized at all stages[26].

Modern trams are equipped with front-facing image transmitters and recording cameras, Lidar, Radar sensors, and information displays in the driver's cabin. These sensors detect all moving objects in front and to the sides, enabling automatic emergency stops or immobilization for objects the driver may not have seen or anticipated. They also detect road signs and traffic light operations to assist driving, helping to anticipate dangers, prevent accidents, and avoid collisions.

Traffic Organisation:

The main traffic accident risk factors are cars, particularly left turns and intersection crossings. Prohibiting left turns would cause unpredictable congestion at intersections. Therefore, the working group must determine where, to what extent, and under what conditions left turns or U-turns can be made during the detailed design phase.

Left turns should be permitted at major city thoroughfares with high traffic volume (Category 1 and 2 roads). From the General Archives terminus toward the city center, the following high-traffic intersections should retain left turns.

- Intersection from Naadamchid Road to CHPP Road
- Intersection of Chinggis Avenue and Engels Road (Narny Bridge)
- 120 (Camel Monument) Intersection
- Central Post Office Intersection

[25] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 161
[26] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 161

U-turns will be permitted only at specific approved locations and only with traffic light control.

Trams will be regulated by a separate traffic signal system that coordinates with road traffic signals. By granting trams priority at intersections, they will be able to pass through intersections directly without any waiting time. Equipment installed on trams will transmit information to each roadside pole, alerting the traffic control system of their approach. Following this principle, when a tram approaches an intersection, the system will notify road traffic signals of its arrival, stop vehicular traffic, activate signals for the tram's direction of travel, and allow the tram to proceed through the intersection without stoppin[27].

3.5.4 Tram truck planning

3.5.4.1 Planning on bridge stuctures

The planned line from Buyant-Ukhaa Sports Complex to Sukhbaatar Square is 15 km long with 23 stops, and Yarmag Bridge and Peace Bridge are located along this route. The following solutions have been developed as options for integrating the tram route with these bridges[28].

Yarmag bridge

Yarmag Bridge is 250.2 m long, 20.5 m wide, with 4 lanes, and together with the old bridge has 6 lanes. The plan fully utilizes two north-south bound lanes with a width of 7 m, designed to pass under the east-west directed estacade[29].

Figure 3-12 Design and Planning of the Overpass Route over Yarmag Bridge

Enkhtaivan bridge

[27] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 166
[28] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 166
[29] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 166

Peace Bridge was commissioned in 1958 and serves as the main road connecting the city center with Khan-Uul District, running north-south over the east-west railway and Selbe River. The Narny Road passes underneath it. Total length: 580 meters, bridge width: 16.8 meters, with two-way vehicular traffic lanes and pedestrian paths.

This bridge remains a symbol of major construction undertaken during the socialist era, representing the architectural and engineering development of that period. Therefore, two alternatives have been developed for integrating the tram route with this bridge: either preserving the architectural style and structure, or in case of expansion, reconstructing the towers according to their original design[30].

Figure 3-13 Current Situation

Newly Planned Alternative-1

The tram route is planned along the center of the existing bridge in two lanes (7.0 m), relocating the pedestrian path to create two-way traffic with one lane, and the bridge would be expanded on both sides to accommodate one vehicle lane and pedestrian paths[31].

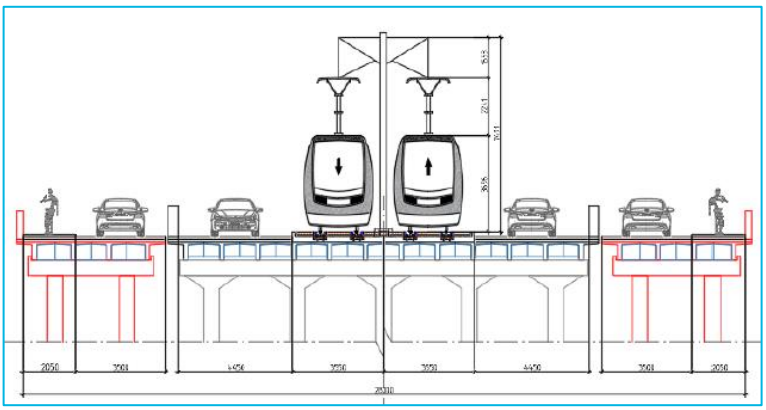


Figure 3-14 Plan, Expanded Alternative

[30] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 167

[31] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 168

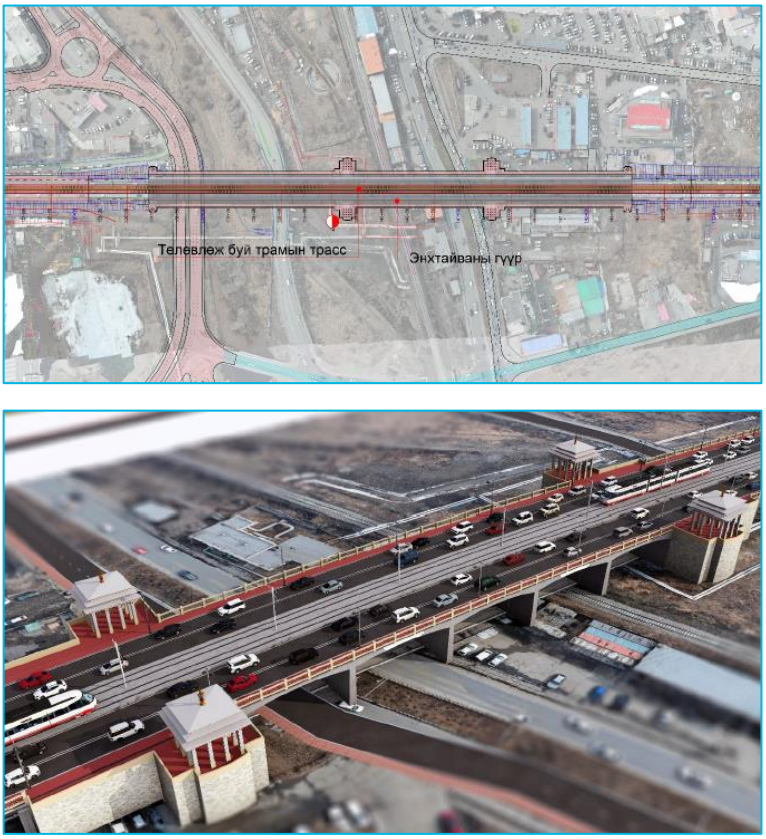
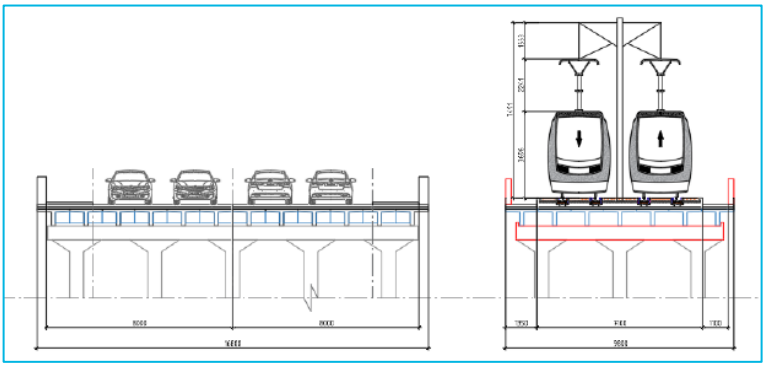


Figure 3-15 Visual Representation, Extended Alternative

Newly Planned Alternative-2

A new bridge structure for the tram route is planned on the east side of Peace Bridge [32].

[32] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 170



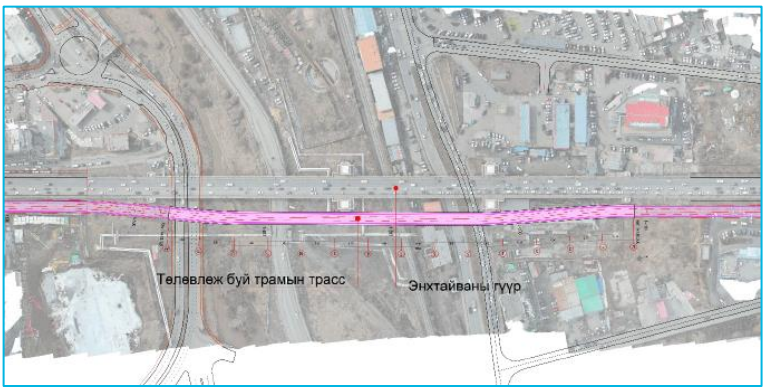


Figure 3-16 Plan, New Bridge Construction Alternative

Figure 3-17 Visual Appearance, New Bridge Construction Alternative

3.5.4.2 Tramway Track Gauge Size and Selection

A tramway track, like a railway, has double rails, and the gauge of the tramway refers to the distance between the two rails. The type of tramway gauge varies depending on many factors such as a country's transport network, economic conditions, geographical location, and vehicle load.

Compared to railways, tramway tracks are placed alongside roads and pedestrian paths in a greater variety of configurations, which is why there are many different gauge sizes[33].

Table 3-2 Basic Basic classification of tramway track gauges

Type of Gauge	Width (mm)	Usage
Standard Gauge	1435 mm	Most commonly used globally
Broad Gauge	1524–1676 mm	Russia, India, Spain, Argentina
Narrow Gauge	600–1067 mm	Mountainous areas, specialized trams

[33] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 172

Type of Gauge	Width (mm)	Usage
Ultra-Narrow Gauge	500 mm or less	Tourist and heritage tramways

In consideration of aligning the Ulaanbaatar tram track gauge with international standards, ensuring the possibility of future expansion, compatibility with other modes of transport, standardized maintenance technologies, and cost efficiency during operation, the selection of the **1435 mm standard gauge** is deemed the most appropriate and optimal solution.

3.5.4.3 Tramway track technical specifications and general requirements

The general specifications and technical requirements of the tramway are broadly developed based on, and aligned with, European standards [34].

№	Parameter	Dimension	№	Parameter	Dimension
	Infrastructure			Rolling Stock	
1	Number of lines	1	8	Tram width	2650 mm
2	Gauge size	1435 mm	9	Tram length	as calculated
3	Track type	without intersection	10	Axle load	12,5 tons
4	Base type	ballastless, slab track	11	Electrical power	560-700 kW
5	Maximum gradient	40 %	12	Capacity	150-240 people
6	Minimum turning radius	50 meters	13	Maximum speed	60-80 km/h
7	Rail	50-65 kg/m, grooved	14	Average speed	30 km/h

Track Structure Selection and Standardized Cross-Sections

Tramway track superstructure, substructure, and pavement are planned in various ways worldwide, depending on local conditions, urban density, road width, available space, overhead networks, and whether tracks intersect with or share space with roads. Tramway track foundation structures differ primarily between ballasted with sleepers and ballastless slab foundations. Modern tramway tracks increasingly incorporate the Embedded Rail System (ERS), where rails are installed in continuous concrete slabs without separate fasteners or bolts.

Ballasted foundation tramways are similar to conventional railway structures and are most suitable for areas without mixed vehicular traffic and with minimal at-grade intersections between cities[35].

Figure 3-18 Track with Ballasted Foundation

Slab foundation tramway tracks are more suitable for passenger transport within cities, and their main advantage is the ability for roads and tramway tracks to travel at the same level[36].

[34] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 174
[35] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 174
[36] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 174

Figure 3-19 Track with Slab Foundation

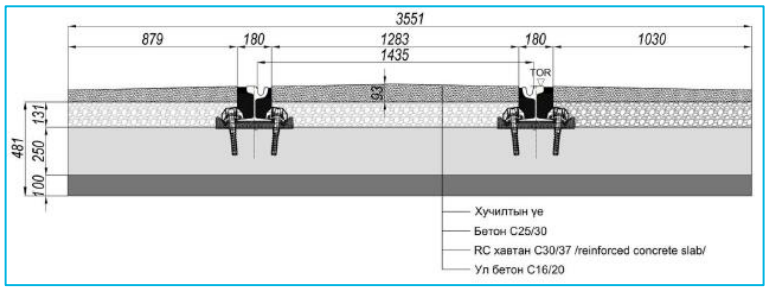


Figure 3-20 Main Track Structure Cross-Section

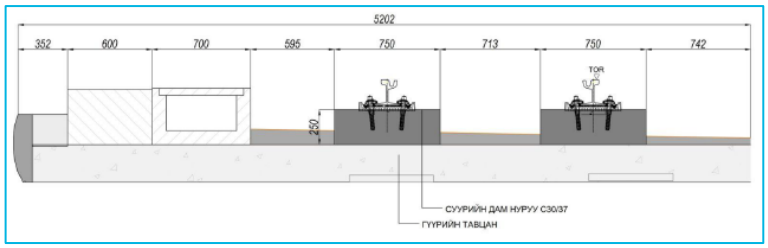


Figure 3-21 Bridge Structure Track Cross-Section

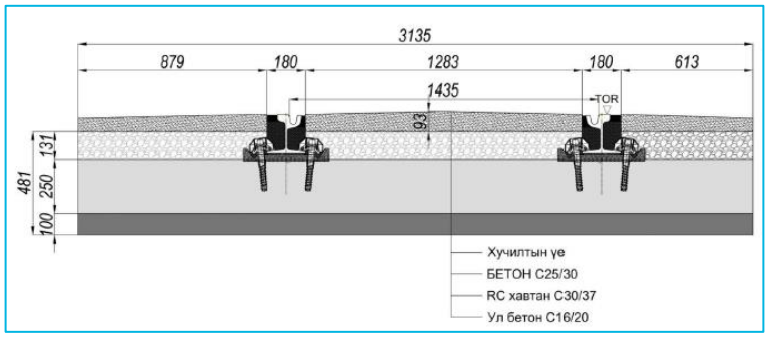


Figure 3-22 Stop Location Track Cross-Section

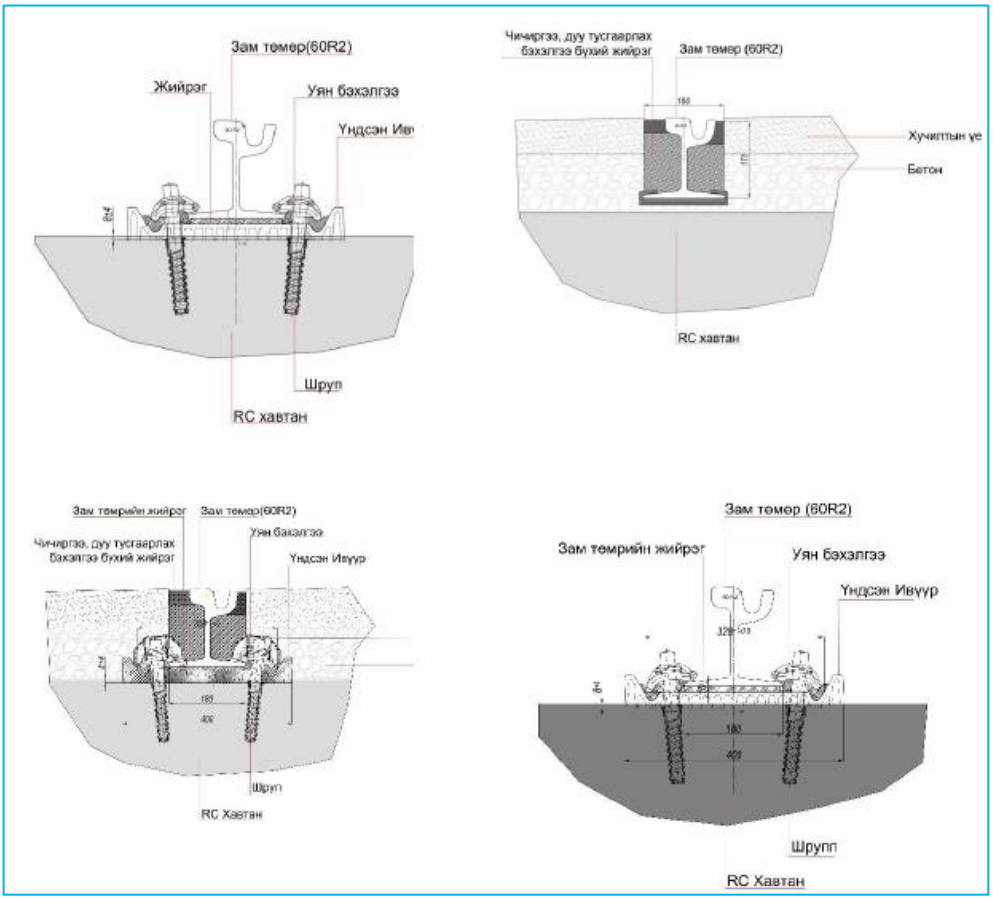


Figure 3-23 Fastening Types

When selecting tramway track superstructure materials, load calculations for each component should be considered, with attention to.

- Track purpose
- Train and rolling stock forces
- Surface type
- Hydrogeological conditions
- Base and longitudinal profile
- Protection of underground utilities from corrosion and wear [37].

Tramway pavements

When selecting the cross-section and structure for the Ulaanbaatar tramway, it is considered more appropriate to adopt a ballastless track with a precast concrete slab foundation, which is widely used in modern tram systems. This type of structure is especially suitable for constructing new tram lines on existing roadways, as it allows for shorter and simpler installation times[38].

[37] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 178

[38] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 180

Figure 3-24 Concrete Slab Paved Road

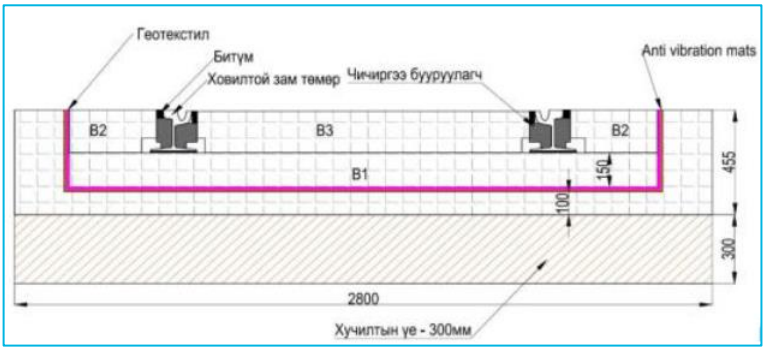


Figure 3-25 Tramway Track Cross-Section

Figure 3-26 Tram Track Installation Work

According to the instructions and technical requirements shown in the above image, foundation preparation activities play an important role in creating quality, stable track structures. Therefore, ground soil compaction should be done in compliance with standards and technical requirements to ensure track foundation stability. For ease and efficiency in track repair and maintenance services, concrete foundations should be manufactured and installed in lengths of no more than 2-3 meters. This allows for correct and quick assembly of the foundation and will help reduce maintenance.

Using geotextile is important to prevent water penetration, swelling, and settling distortion in the ground soil, which will positively impact soil stability. Additionally, laying rubber gaskets along the entire length to reduce track noise and vibration levels plays an important role in traffic safety and user comfort. Detailed working drawings and plans must clearly specify ground soil slopes and concrete foundation gradients, and water flow and drainage pipes must be placed as required. Properly planning the water drainage system is important for protecting against water accumulation

and track damage. Also, correct placement of drainage pipes will make it possible to prevent problems caused by water effects[39].

3.5.4.4 Drainage system

A drainage system will be installed along the railway corridor. Surface water from the roadway will be collected through grated channels intersecting perpendicularly at specific intervals along the slope, discharging into existing drainage facilities or appropriately located drainage lines. When using closed drainage systems, the contractor must install sufficient manholes and inspection points to ensure system cleaning, inspection, and maintenance. In cut and embankment sections, trapezoidal side ditches with 1H:1V slopes will be constructed, discharging into appropriate drainage systems.

Slope and embankment protection will be implemented using surfacing materials that comply with domestic and international practices. Structural designs for culverts will be developed in accordance with relevant domestic and international standards. Existing culverts under roadways will be modified for use with the tram line construction while maintaining their current characteristics. Required structural designs and implementation methodologies will be presented to the client. To facilitate construction, maintenance, and renovation, culverts should be standardized with modular structures for easy assembly. Materials and technologies meeting environmental and sustainable development requirements will also be studied and implemented[40].

3.5.4.5 Truck base slabs

As mentioned in the track structure selection section, ballastless, sleeper-free construction using prefabricated track-road slabs will be used for the tram track foundation. These prefabricated slabs may have various designs, structures, and purposes. The basic slab with a rail groove is designed for tram tracks where tram traffic is mixed with road traffic and can be used for all types of railway profiles including single and double tracks, intersections, straight sections, and curves.

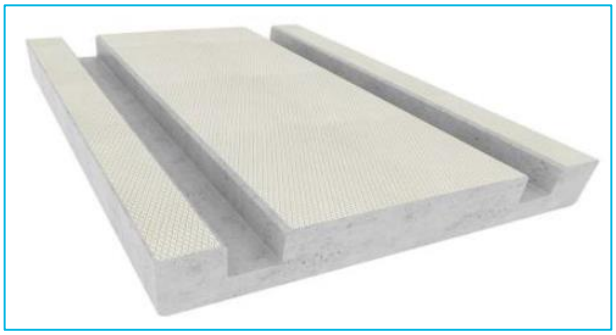


Figure 3-27 Basic Slab with Rail Groove (LC-L)

The basic slab with rail groove can be manufactured in standard dimensions as shown in the table below, with slab dimensions selected according to track gauge, profile, and cross-section. Custom-sized slabs can also be manufactured according to project requirements[41].

Table 3-3 Specifications of Basic Slab with Rail Groove

№	Specification	Dimension
1	Width	2.40m, 2.20m, 2.00m, 1.76m
2	Thickness	0.35m, 0.40m

[39] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 181
[40] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 182
[41] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 186

№	Specification	Dimension
3	Length	1.0m, 1.5m, 3.0m, 4.0m, 6.0m
4	Rail	49E1, 60R2
5	Gauge Width	1000mm, 1435mm
6	Radius	≥650m (6.0m Slab), ≥300m (4.0m Slab), ≥180m (3.0m Slab)
7	Applicable use	All types of track

3.5.4.6 Insulation materials for base slabs

Insulation materials for tram track base slabs serve the primary purpose of softening, evenly distributing, and absorbing loads from rolling stock, reducing vibration and noise, and minimizing negative impacts on the surroundings, which positively affects passenger comfort and residents living near the tracks.

Base slab insulation materials include STM - Slab track mats (vibration insulation pads), Polyrail - rail insulation liquid, Railshim - rail insulation gaskets, Railstrip - rail elastic pads, Railfiller - filler rubber blocks, Railwedge - rail fastening wedges, and Railspacer - materials insulating rails from cables[42].

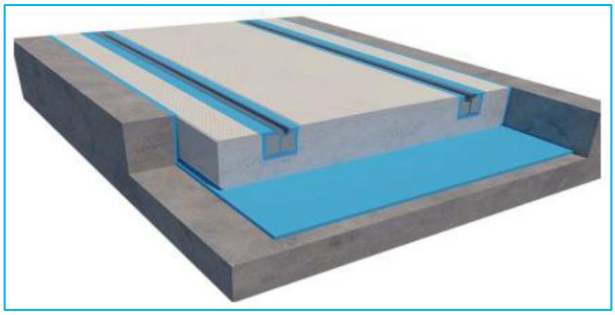


Figure 3-28 Polyurethane Vibration Isolation Pad for Slab Track

Figure 3-29 Polyrail – Rail Insulating Liquid

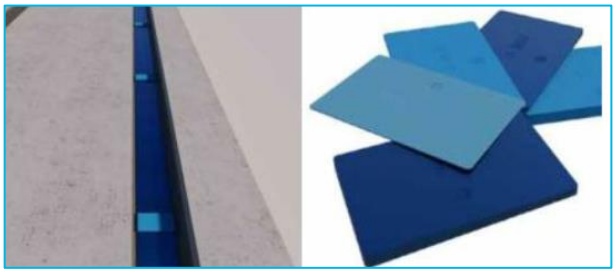


Figure 3-30 Railshim – Rail Insulating Gasket

[42] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 189

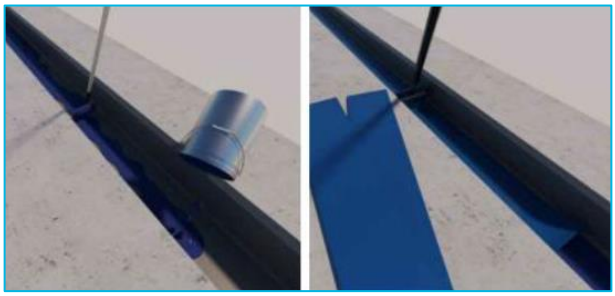


Figure 3-31 Railstrip – Rail Elastic Pad

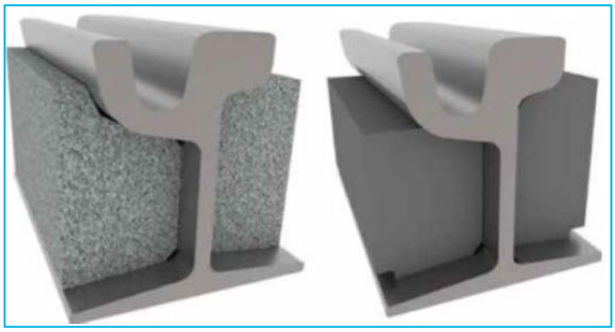


Figure 3-32 Railfiller – Filler Rubber Block

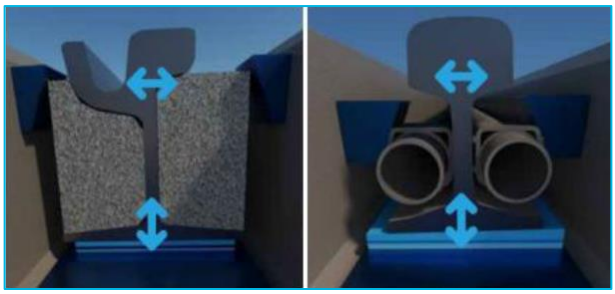


Figure 3-33 Railwedge – Rail Fastening Wedge

Figure 3-34 Material for Insulating Rails from Cables

Track clearance

Clearance refers to the limited space established in accordance with traffic safety and technical requirements for the safe positioning of tram track objects, rolling stock, nearby buildings and structures, and cargo. The minimum permissible distance from the centerline of the straight section of the tram track to buildings, structures, and pedestrian paths is shown in the following figure.

Tram track clearance dimensions were developed based on the Russian Federation's SP84.13330.2016 standard[43].

[43] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 193

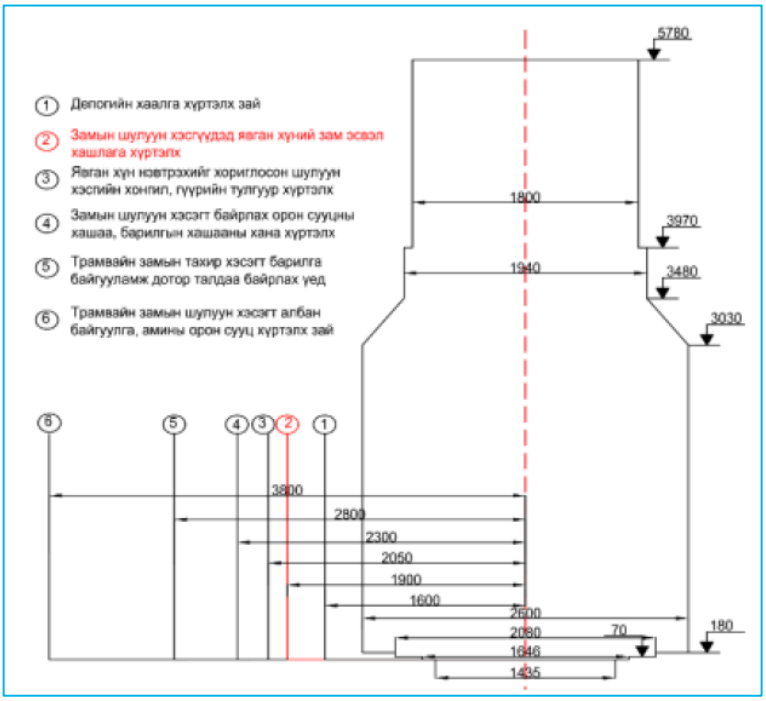


Figure 3-35 Tram Track Clearance Requirements

3.5.5 Planning solution for relocating engineering networks along the tramway route

3.5.5.1 Heating Supply System

After obtaining utility network clarifications from Ulaanbaatar Heating Network SOE (UBDS TÖHK) and the Heating Infrastructure Implementation Agency (KHIHUG), calculations were made for four tramway route alternatives. These four options were compared with respect to road alignment, architecture, spatial layout, land acquisition, and other related factors. As a result, the most optimal and feasible option Alternative 1 was selected for developing the feasibility study (FS).

Along the planned tramway alignment, a total of 1,675 meters of heating pipelines with diameters ranging from 2f150 to 800 mm, owned by Ulaanbaatar Heating Network SOE, intersect at 17 locations. Of these, 13 locations involve pipelines crossing the tramway route, with a combined length of 515 meters. At 4 locations, pipelines are situated along (parallel to) the route, with a total length of 1,040 meters. At 2 of these crossing points specifically locations 2 and 6, the heating pipelines, totaling 120 meters, are currently within accessible channels.

To avoid complications during operation, such as repair, maintenance, expansion, or renovation of the affected heating pipelines, it is planned to install the crossing sections within accessible channels, relocate the pipelines running parallel to the tram route, and reinforce the concrete channel covers [44].

[44] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 194

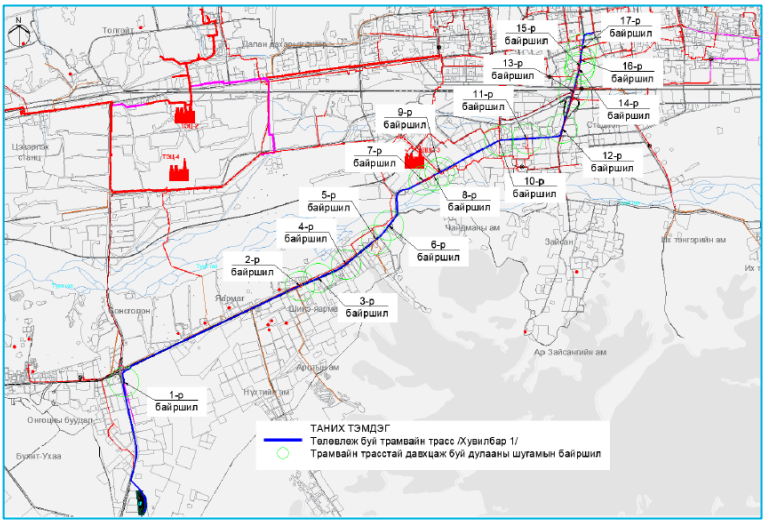


Figure 3-36 Networks Intersecting Along the Route

Protecting heating networks with access channels:

Heating network pipes intersect with the planned tramway route at 13 locations (locations 1, 3, 4, 5, 9, 10, 11, 12, 14, 16, 17), and it is planned to place a total of 515m of pipeline in access channels to facilitate easy repair of any damage that may occur during operation[45].

Relocation and reinforcement of heating pipeline network:

According to the plan, the heating pipeline network intersects with the planned tram route at 4 locations - positions 7, 8, 13, and 15. These heating pipelines are located along the tram route. It is planned to relocate a total of 800m of heating pipelines with diameters of 2ф150 and 2ф800mm by shifting them 3-8 meters to the east, and to reinforce the covering slabs of 240m of heating pipeline with diameter 2ф150mm[46].

Depot building heating and ventilation:

The depot building will have a complete heating and ventilation system that meets the requirements of BNbD 41 01 11 norms, rules, and standards.

Heating system:

1. Install a heat meter at the inlet node of the heating system to monitor consumption
2. Properly insulate the heating system pipelines
3. Install adjustment valves on each heating device
4. Fully automate heating and hot water supply

Ventilation system:

1. Plan mechanical exhaust and supply ventilation systems
2. Fully automate the ventilation system

Plan smoke extraction and pressurized air supply systems for fire events. The smoke protection system will operate with automatic alarm in case of fire, at which time the exhaust system valve will open, the smoke extraction fan will operate to remove smoke. After this, the pressurized air supply fan will operate to provide pressurized clean air to the tunnel[47].

[45] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 194
[46] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 195
[47] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 198

3.5.5.2 Current Status of Engineering Preparation Measures and Planning Solutions

Along the newly planned 15 km tramway route from Buyant-Ukhaa Sports Complex in the 21st khoroo of Khan-Uul District to Torgonii Road Complex, and from the 120 thousandth intersection to Sukhbaatar Square, the existing rainwater collector K-4 pipeline intersects at 15 locations, with a total length of 1240 m along the tramway route. The existing rainwater drainage line has been constructed according to road elevation planning, and due to limited space for relocation, it can be renovated along its existing route.

From the Buyant-Ukhaa complex to Peace Bridge section of the tramway route, working drawings have been prepared for both sides of the road, and according to Ulaanbaatar city's 2040 Development Master Plan, 26,200 m of new rainwater drainage lines are planned. This needs to be implemented in coordination with the tramway construction work according to the working drawings. The total length of rainwater lines is 26,200 m[48].

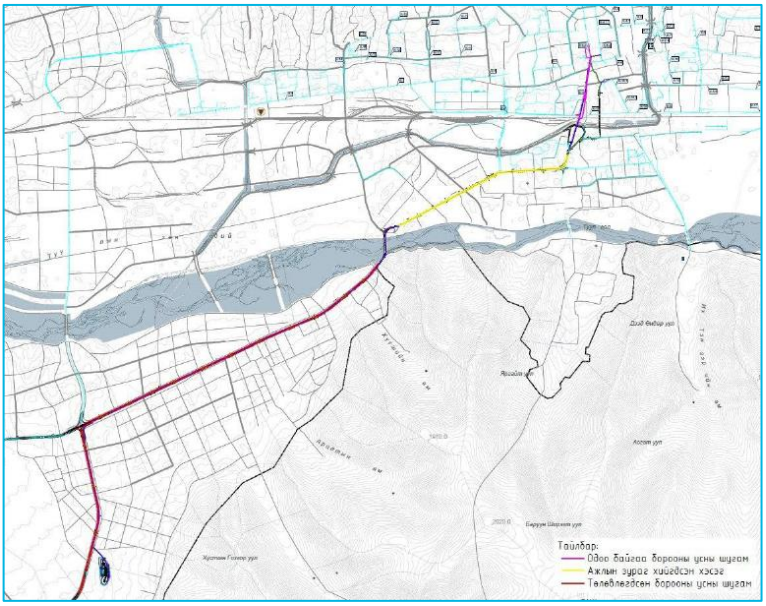


Figure 3-37 Networks Intersecting Along the Route

3.5.5.3 Current Status of Water Supply System and Planning Solutions

The 15.0 km long tramway route newly planned from Buyant-Ukhaa Sports Complex in the 21st khoroo of Khan-Uul District to Silk Road Complex, and from the 120 thousandth intersection to Sukhbaatar Square has been developed with four alternatives.

Along this route, water supply lines with diameters from φ110-500 mm owned by USUG and OSNAAG are located in 12 locations in both crossing and parallel positions[49].

[48] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 199
[49] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 200

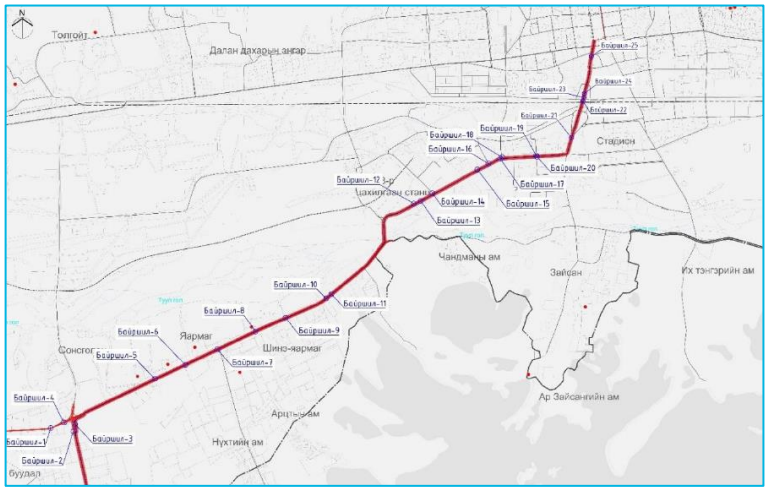


Figure 3-38 Clean Water Networks Intersecting Along the Route

Water Supply System Protection and Planning Solutions:

Clean water lines cross the tramway route at 17 locations and run parallel at 8 locations. Therefore, the following measures are planned:

1. Plan full access channels: At locations 1, 3, 8, 9, 13, 17, 20, 21, 22, 24, lines with diameters φ200-φ700mm are planned to be protected by placing 495.0 linear meters in access channels.
2. Plan combined access channels with other engineering networks: At locations 3, 10, 11, 25, lines with diameters φ200-φ500 are planned to be protected by placing 359 linear meters of clean water lines together with other engineering networks in a single channel.
3. Use reinforcement lining method: At locations 14, 15, 16, 18, 19, 23, protect 301 linear meters of φ500mm diameter clean water lines using the reinforcement lining method.
4. Adjust existing access channels to road elevation: At locations 4, 5, 6, 7, repair access channels for existing φ200mm diameter clean water lines of 226 linear meters to coordinate with tramway elevation.
5. Relocate clean water lines running parallel along the route: At location 2, relocate 218 linear meters of 200mm diameter lines away from the tramway route.
6. At location 12, relocate 422 linear meters of clean water lines located in heating channels running parallel along the tramway route together with the heating supply lines[50].

Clean water pipelines located along the track are mostly steel pipes. In recent years, reinforced polyethylene HDPE pipes have been used more frequently, but steel pipes are still used in heat ducts. Currently used steel pipes are corroded and deteriorated, with reduced nominal diameter due to scale formation, infiltration and exfiltration processes exceeding acceptable levels, and high risk of pipeline rupture, which has led to the use of plastic pipes in recent years with good results.

Analysis of previously developed project drawings and construction cost estimates shows that although there is a small price difference depending on the pipe material, the final price is approximately the same due to transportation and construction work. When selecting materials for intersecting water transmission pipelines, the following conditions should be considered:

- Pipe material wear condition
- Pipe installation and operation conditions
- Pipe supply conditions
- Pipe price and technological requirements [51]

[50] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 201

[51] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 203

3.5.5.4 Sewage system Planning Solutions

The newly planned 15 km tram track from Khan-Uul District's 21st khoroo, Buyant-Ukhaa Sports Complex to Torgonii Road Complex, from the 120 thousandth intersection to Sukhbaatar Square has been developed with four options.

Along this track, sewage pipelines with diameters of Φ160-1400mm intersect at a total of 23 locations, running both perpendicular and parallel[52].

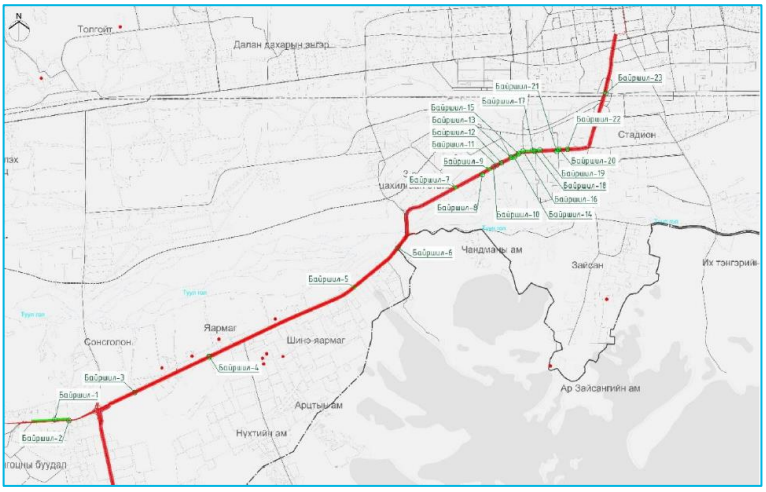


Figure 3-39 Sewage network crossing along the track

Along the tram track, sewage pipelines cross perpendicularly at 17 locations and run parallel at 6 locations. Therefore, the following measures are planned:

Plan complete access channels:

1. Plan complete access channels: At locations 2,5,7,9,10,11,12,13,15,17,22,23, sewage pipelines with diameters of ф160-1400mm will be protected in 519 linear meters of access channels.
2. Plan complete access channels together with other engineering networks: At location 6, a ф300mm diameter sewage pipeline will be protected together with other engineering networks in a 42 linear meter access channel.
3. Use reinforcement lining method: At locations 8,19,20,21, sewage pipelines with diameters of ф300-800mm and 214 linear meters will be lined using SPR technology.
4. Adjust existing access channels to coordinate with road elevation: At locations 3 and 4, sewage pipelines with diameters of ф300,800mm and 148 linear meters will be repaired in coordination with road elevation.
5. Relocate sewage pipelines running along the track: At locations 1,14,16,18, sewage pipelines with diameters of ф300-800mm and 1188 linear meters will be relocated away from the tram track[53].

Clean and Sewage Pipeline Renovation Technology:

In Ulaanbaatar, accidents involving road subsidence and collapse due to old pipelines are rare but do occur. If old pipelines are not renovated, the following issues may arise:

1. Road subsidence and collapse accidents due to old pipeline failures caused by tram weight
2. Sewer backups due to blocked old pipelines, making it impossible for citizens to use the sewage system. Also, unpleasant odors may contaminate the living environment

[52] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 205
[53] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 206

3. Soil contamination near pipelines due to sewage leaking from cracks and damaged sections of old pipelines
4. Potential disruption in the reliable and continuous supply of clean water to consumers

Therefore, to prevent issues before they occur, renovating aged and damaged pipelines would ensure uninterrupted sewage services and complete public utility service.

The lining method is planned for use in difficult excavation and renovation areas (replacing pipelines), particularly in downtown areas with heavy traffic and green spaces.

There are trenchless pipe lining methods for pipeline renovation. In Ulaanbaatar, the pipe insertion lining method is used for clean water pipelines. USUG is interested in using the insertion lining method in the future to renovate sewage pipelines installed under high-traffic roads. As shown in the table, insertion lining methods include inversion, pneumatic installation, pipe connection, and lining methods[54].

Planning for the water supply system at the tram's terminal:

Fire extinguishing time - Fire water will be planned based on an average of 30-60 minutes. It is appropriate to plan a simple fire extinguishing system with a flow rate of q=20.0L/s and an automatic fire extinguishing system. In the cold season, it is necessary to prevent pipelines and equipment from freezing. To prevent fire hazards, it is important to accurately calculate water needs and ensure reserves. For this purpose, it is necessary to optimally plan centralized and reserve water supplies and ensure readiness for use when needed[55].

3.5.5.5 Current Status of Electrical Supply System and Planning Solution

Information communication lines along LRT route:

In the planning area of the route from Buyant-Ukhaa Sports Complex to Torgonii Road Complex, from the 120 thousandth intersection to Sukhbaatar Square, 315 communication wells, 35.7 kilometers of channeling facilities, 148 aerial poles, and 52.6 kilometers of cable lines have been found[56].

Information Communication Infrastructure Planning for the High-Capacity Public Transport Project in Ulaanbaatar City:

The Light Rail (tram) project will serve two main directions. The second direction is 15 km long in total from Buyant-Ukhaa Sports Complex to Torgonii Road Complex, from the 120 thousandth intersection to Sukhbaatar Square.

Traffic lights and control panels, RFID antenna poles at the following locations are within the tram track route and need to be relocated to the side of the road[57].

Planning:

Since communication channels crossing the planned route are installed at depths of less than 80cm in some sections, according to the recommendations provided by Information Communication Network LLC, wells will be installed on both sides of the road, the channel level will be lowered to 1.2 meters, and the channel will be protected with L2 trays to allow for future expansion.

[54] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 207
[55] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 210
[56] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 210
[57] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 211

3.5.5.6 Power Supply System Assessment and Planning Solution

Along the new tram line route, 0.4 kV, 10 kV, and 35 kV overhead and cable power lines are present, which need to be regulated, protected, and relocated to meet safety requirements.

10-35 kV Overhead Power Lines:

The standard height of support poles for 10 kV and 35 kV overhead lines is 10-18 m, while the height of tram contact wires is 5.5-6.5 m. Therefore, the following measures are planned to prevent intersection with overhead lines:

Adjusting line height and distance according to standards:

- 10 kV line → minimum 2.5-3 m distance from tram contact wire
- 35 kV line → 3.5-4 m distance from tram contact wire

- Studying the possibility of relocating high-voltage lines in different directions
- Increasing the height of power line poles if relocation is not possible
- Calculating the option of replacing with underground cable lines

0.4 kV Power Cable Lines

0.4 kV power transmission lines are typically underground with ducting systems or directly buried. In zones overlapping with tram foundation structures, the following adjustments will be made:

- Placing cable lines in protective troughs or duct systems to protect from mechanical damage
- Studying the technical possibility of redirecting cable lines that pass under the tram route
- Checking and updating power supply reliability in tram foundation structure zones if necessary

The following electrical supply lines and networks were encountered along the route[58].

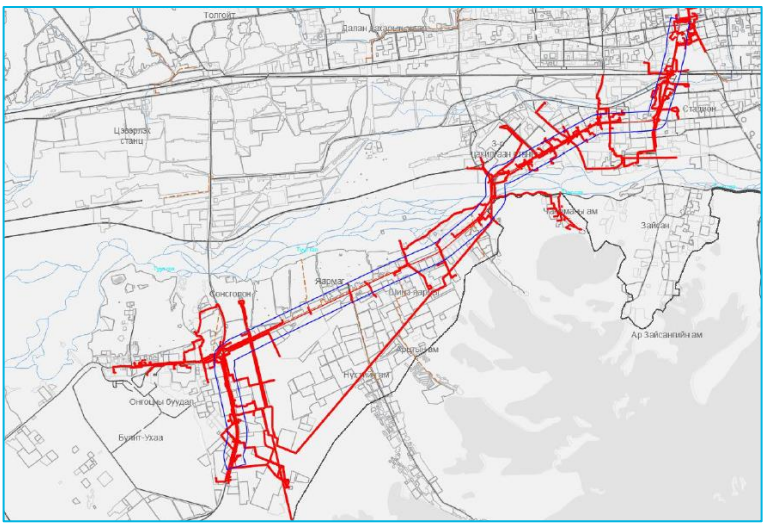


Figure 3-40 Electrical Lines and Networks Encountered Along Route-2

Impact of Road Expansion and Regulation of Engineering Networks

Within the framework of planned road expansion and renovation along the tram route, engineering networks (overhead and cable lines) that intersect with or are located within the route may be affected, requiring relocation of lines and networks or placement in protective troughs. The table includes only electrical lines and networks that intersect the road or are located within the tram route[59].

[58] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 215
[59] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 216

Planning

Since culverts crossing roads are installed at depths less than 1.0m, following recommendations from the National Electricity Distribution Network LLC, cable tensions will be performed using cable detection equipment to lower them to depths of up to 1.2 meters to avoid interference with the tram route, and they will be installed in protective cable ducts[60].

Table 3-4 Planning Solution

Line Type		Measuring Unit	Within Road Expansion Route	Planning
Cable Line		m	17,384	Relocate, transfer, and place in cable ducts under the road
Overhead Line	**35 kV**	Location	2	Overhead Line
	6 kV	Location	1	Зөөж шилжүүлэх, трассын дагуу огтлолцлыг байршил өөрчлөх

Along the 15 km tram route from Buyant-Ukhaa Sports Complex through Torgony Zam, 120 thousandth intersection, to Sukhbaatar Square, it is necessary to plan power transmission line surveys, engineering solutions, and protective measures. It is important to conduct detailed studies of power transmission overhead and cable lines along and intersecting the route, making necessary adjustments to ensure project safety and reliable power supply.

Table 3-5 Planning Solution

Line Type		Unit	Included in the Road Expansion Alignment	Planning
Cable Line		m	20,325	Recolate, transfer, and place in cable ducts under the road
Overhead Line	**35 kV**	Location	6	Recolate, change intersection location along the route
	6 kV	Location	2	Recolate, change intersection location along the route
	10 kV	Location	3	Recolate, change intersection location along the route

3.5.6 Power Supply and Electrical Planning

The planning of the tram power supply system was developed according to international and Mongolian relevant standards, norms, and regulations, including:

- Russian GOST standards - specifically GOST 23476-79 (Technical requirements for tram and trolleybus contact network fittings), GOST 2584-86 (Technical conditions for contact wires), GOST 12.1.038-82 (Acceptable electrical safety limits), used to detail contact wire type, cross-section, transmission capacity, safety, etc.
- Mongolian MNS and BNbD (Building Norms and Regulations) - MNS 5560:2019, BNbD 3.05.06-90, BD 43-101-03, MNS IEC 60364 applied to power supply systems, substation solutions, grounding, voltage drop, and safety operation.
- SP (SNiP) and technical conditions - SP 52.13330.2011 (Lighting), SP 51.13330.2011 (Noise and protection), etc.

The tram project is planned to run from Buyant-Ukhaa Sports Complex through Torgony Zam, 120,000 intersection, to Sukhbaatar Square, with a total length of **15 km**. The contact network line will have a **total length of 30 km**. The Buyant-Ukhaa - Sukhbaatar Square tram system will have a total length of 15 km with the total length of the contact network power supply planned at **30 km**.

The tram system belongs to the first category of power supply reliability. Therefore, rectifier substations will be fed from two sources that back each other up.

[60] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 216

The power supply for the tram contact network and maintenance depot will be planned according to technical conditions provided by the Ministry of Energy, including:

- Contact line power will be supplied through 10/0.7 kV Rectifier substations.
- Depot power supply will be resolved through a 10/0.4 kV Depot substation (KTP).
- A backup generator will be installed to ensure uninterrupted depot operation during power outages.

The newly planned tram rolling stock will operate on 750V DC power supply, and the power supply calculations and planning have been developed based on this parameter.

The 750V DC system is widely used internationally, is compatible with advanced technology equipment, and represents a reliable, efficient solution for Mongolia's conditions. Within this system, rectifier substations that convert AC to DC will be positioned along the route to power the contact network. The substations will be interconnected to back each other up, reducing voltage drop and ensuring reliable power supply operation. This increases supply stability and creates conditions for continuous normal system operation.

The total installed power for the 15 km tram line rolling stock will be 8.9 MW, and according to technical conditions provided by the Ministry of Energy, power will be supplied from 110/35/10 kV, 35/10 kV substations at 10 kV level via cable lines, converted to 750V DC through rectifier substations and distributed through the tram contact network[61].

3.5.6.1 Power Supply System Planning

The 15 km long Buyant-Ukhaa - Sukhbaatar Square tram line will be served by 18 train sets. Each tram will consist of a formation with 3 sections, with each section having a traction motor.

According to preliminary calculations, one rolling stock motor will consume a total of 560 kW of electricity. However, motor capacity can be reduced during the project implementation phase, considering capacity, load, and economic efficiency. The total installed capacity of this tram line is 8.9 MW, while the total transformer capacity is 16 MVA. Tram installed capacity

- Total: 560 kW
- 560kW x16(number of trains) = 8960 kW

Calculated Capacity

The planned 15 km tram line will have a normalized substation spacing of 2 km with a total of 8 rectifier substations. At peak load, it is calculated that 3 trains will travel simultaneously within one substation's coverage area.

- 3 x 560 kW = 1680 Kw
- 1680 x 3= 5040 kW (3 trains within one substation’s coverage area)[62]

Source Planning

According to clarification No. 01/267 dated 13.02.2025 from Ulaanbaatar Electricity Distribution Network LLC, near the 15 km tram route from Buyant-Ukhaa to Sukhbaatar Square are substations supplied by the Central Energy System: Tashgai 110/35/10, Nukht 110/10, North Yarmag 110/35/10kV, Esgiilekh 110/10kV, and Urgoo 110/10kV. These substations will supply the planned tram electricity consumption [63].

[61] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 218

[62] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: Planning Concept, Ulaanbaatar City, Page 219

[63] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 219

Table 3-6 Substation

№	Name of the Existing Substation	Planned Rectifier Substation
1	Tashgai 110/35/10 kV	Rectifier Substation-1
2	Nukht 110/10 kV	Rectifier Substation-2
3	North Yaarmag 110/35/10 kV	Rectifier Substation-3
4	North Yaarmag 110/10 kV	RectifierSubstation-4
5	North Yaarmag 110/10 kV	RectifierSubstation-5
6	Esgiilekh 110/10 kV	Rectifier Substation-6
7	Urgoo 110/10 kV	Rectifier Substation-7
8	Urgoo 110/10 kV	Rectifier Substation-8

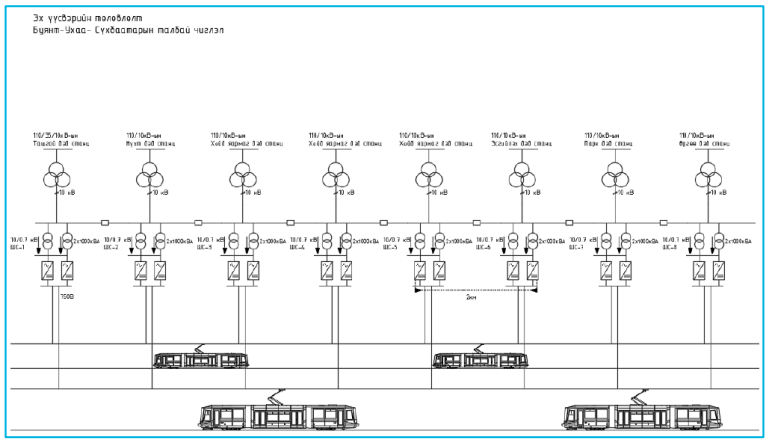


Figure 3-41 Power Supply System Planning

3.5.7 Depot facility planning

Depot General Planning

The depot is a facility with the primary purpose of ensuring the quality of passenger rolling stock operations as well as performing technical maintenance of rolling stock. Since high-capacity urban rail transport systems transport a large number of passengers at once, it is necessary to fully ensure safety, technical reliability, and continuous passenger transport operations.

Additionally, the main purpose of the depot building and facilities is to ensure technical readiness for passenger transport operations by maintaining the technical completeness, normal operation, and safety of rolling stock. Facilities for technical inspection, routine maintenance (scheduled and unscheduled), major repairs, cleaning, and services are planned in an integrated manner according to technology. The job descriptions, duties, and responsibilities of the depot employees will also be determined[64].

It is open for the project construction contractor to provide an optimal technical solution incorporating the advantages of the latest advanced technology with shorter maintenance cycle times and lower routine maintenance costs[65].

[64] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 252
[65] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 253

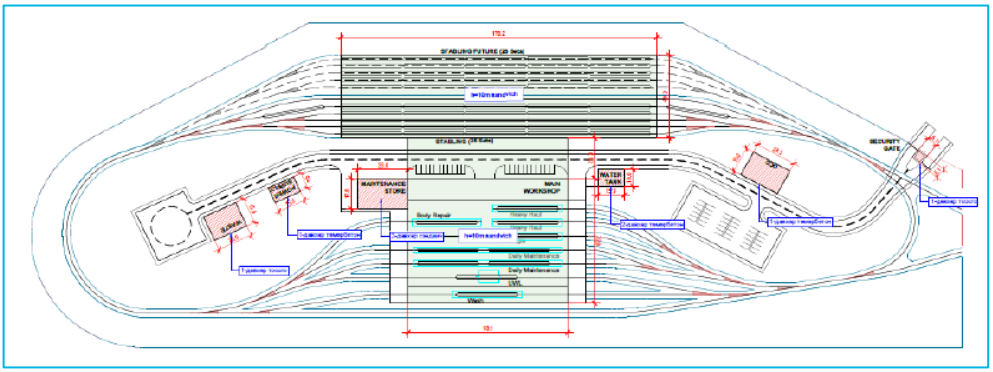


Figure 3-42 General Depot Planning

Figure 3-43 Appearance of the Depot Facility

Depot Planning

The rolling stock repair system is divided into 3 types.

1. Preventive maintenance
2. Unscheduled repairs
3. Preparation for passenger transport (ensuring technical readiness)

Preventive maintenance is an important repair to ensure reliable and safe technical operation of rolling stock. Failure to perform preventive maintenance will result in an inability to ensure normal reliable technical operation of rolling stock, leading to sudden breakdowns and damage. In such cases, it may be necessary to suspend operations for a certain period to ensure passenger safety.

Integrated management of the depot and other facilities, with the additional buildings including:

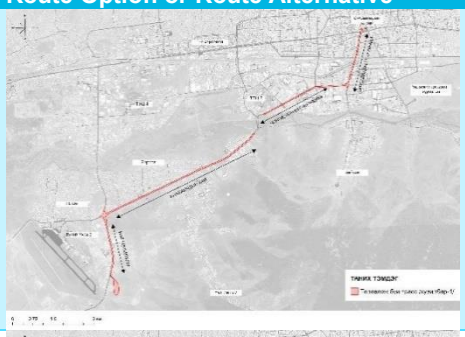
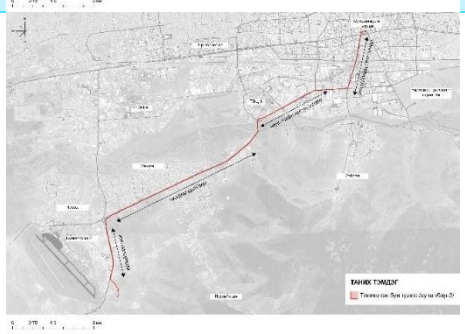
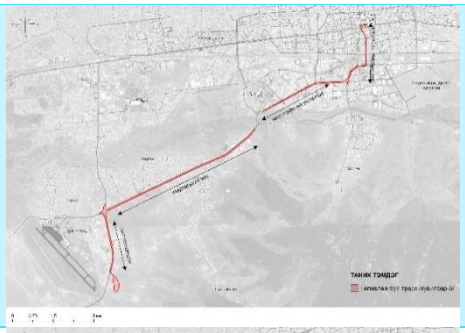
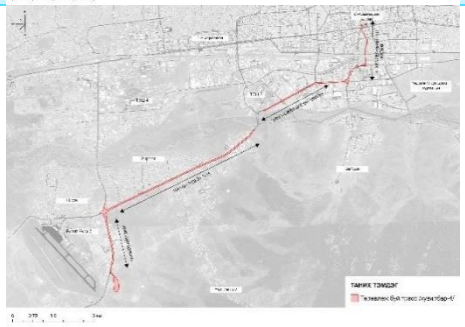
- Sections for technical service and routine maintenance
- Security guard station
- Central operations/control building
- Water supply facility
- Traction substation building
- Rolling stock washing facility
- Waste collection area for all types of waste[66].

[66] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 255

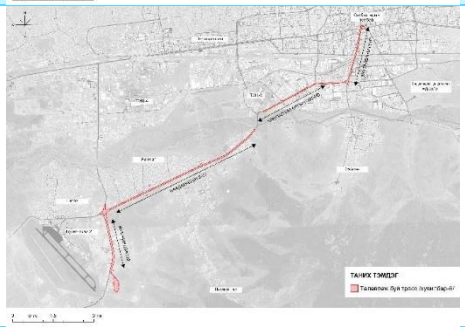
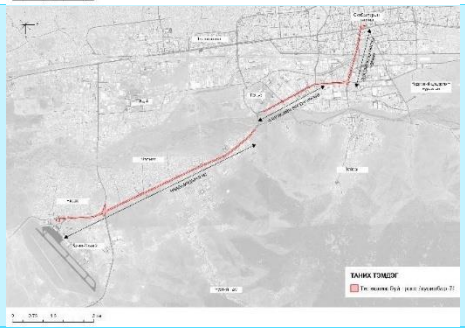
3.6 Route Selection

In selecting the planning route, a total of seven alternatives were developed, compared, and thoroughly studied. These alternatives were evaluated based on several key indicators including primary travel direction, suitability of turns, land acquisition requirements, and engineering infrastructure complexity. Based on this comprehensive assessment, Alternative 1 was identified as the optimal solution and selected for implementation.

Table 3-7 Project route proposals[67]

	Route Option or Route Alternative	Explanation
1		Road Length - 14.6 km Single lane expansion - 2.77 km Double lane expansion - 0.52 km Number of lanes - 2 Railway length - 15.3 km Number of stations - 21 Stations with single-level crossing - 21 Stations with service centers - 0 Rolling stock (vehicles) - 16
2		Road Length - 13.3 км Single-lane expansion - 2.77 км Double-lane expansion - 0.2 км Number of lanes - 2 Railway length - 15.3 км Number of stations - 21 Stations with single-level crossing - 21 Stations with service centers - 2 Rolling stock (vehicles) - 16
3		Road Length - 13.5 км Single-lane expansion - 0 Double-lane expansion - 1.2 км Number of lanes - 2 Railway length - 15.7 км Number of stations - 22 Stations with single-level crossing - 22 Stations with service centers - 2 Rolling stock (vehicles) - 16
4		Road Length - 13.4 км Single-lane expansion - 0 Double-lane expansion - 1.2 км Number of lanes - 2 Railway length - 15.8 км Number of stations - 23 Stations with single-level crossing - 23 Stations with service centers - 2 Rolling stock (vehicles) - 16

[67] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 125

	Route Option or Route Alternative	Explanation
5		Road Length - 13.6 км Single-lane expansion - 2.77 км Double-lane expansion - 0.4 км Number of lanes - 2 Railway length - 15.4 км Number of stations - 22 Stations with single-level crossing - 22 Stations with service centers - 2 Rolling stock (vehicles) - 16
6		Road Length- 12.5 км Single-lane expansion - 2.77 Double-lane expansion - 0.52 Number of lanes - 2 Railway length - 15.2 км Number of stations - 21 Stations with single-level crossing - 21 Stations with service centers - 2 Rolling stock (vehicles) - 16
7		Road Length- 14.3 км Single-lane expansion - 2.77 Double-lane expansion - 1.92 Number of lanes - 2 Railway length - 14.6 км Number of stations - 23 Stations with single-level crossing - 23 Stations with service centers - 2 Rolling stock (vehicles) - 16

3.6.1 Land Acquisition Calculation

Along the planned route, a total of 28,245 sq.m of land across 59 land units have been allocated for possession and use by citizens and business entities. Of these, 28,131 sq.m across 55 land units have been allocated for possession, and 114 sq.m across 4 land units have been allocated for use.

When examining land use purposes, land has been allocated for 16 different types of purposes. Of these, 7,559 sq.m across 28 land units have been allocated for trade, public service areas, centers, and complexes, representing 47% of total land allocations. 1,210 sq.m across 6 land units have been allocated for production buildings, facilities, and other land purposes, accounting for 10% of total land allocations. 630 sq.m across 6 land units have been allocated for residential purposes with commercial services, accounting for 10% of total land allocations. 18,846 sq.m across 19 land units have been allocated for other purposes, accounting for 32% of total land allocations.

Alternative 1

Land acquisition for Alternative 1 was calculated with widths of 38 meters along Olziit Road, 42 meters along Naadamchid Road, 28 meters along Chinggis Avenue, and 25 meters along Peace Avenue.

The base valuation for land acquisition of 28,245 sq.m across 59 land units affected by the route is 1.4 billion MNT. The valuation for 4,375 sq.m across 7 land units affected by the transformer

substation location is 0.56 billion MNT, bringing the total land acquisition compensation to 2.0 billion MNT[68].

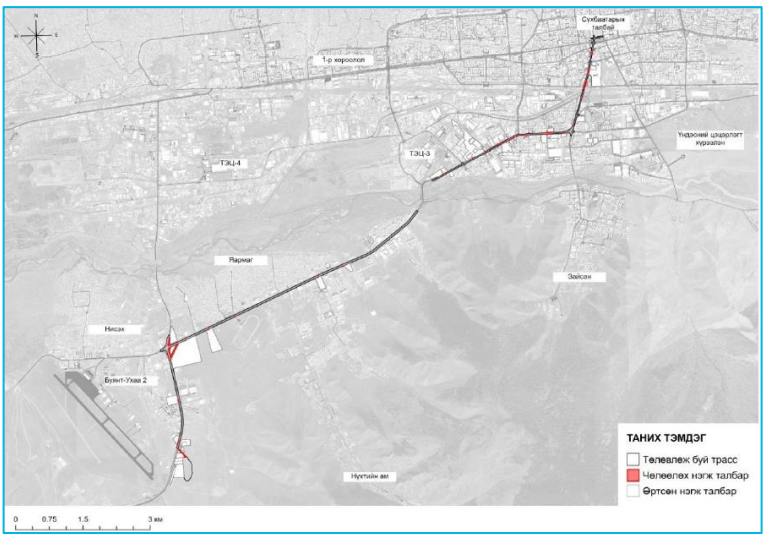


Figure 3-44 Land Acquisition /Alternative-1/

Table 3-8 Base Valuation of Land Acquisition for Land Units Affected by the Route /Alternative-1 /

№	Alternative 1	Number of land units	Area (sq.m)	Land acquisition cost (million MNT)
1	Route 2	59	28,245	1,437.7
2	Transformer substation	7	4,375	560
Нийт		Total	**66**	**32,620**

Alternative 2

Land acquisition for Alternative 2 was calculated with widths of 38 meters along Ulziit Road, 42 meters along Naadamchid Road, 28 meters along Chinggis Avenue, and 35 meters along Peace Avenue.

The base valuation for land acquisition of 28,532 sq.m across 62 land units affected by the route is 1.63 billion MNT. The valuation for 4,375 sq.m across 7 land units affected by the transformer substation location is 0.56 billion MNT, bringing the total land acquisition compensation to 2.2 billion MNT[69].

Table 3-9 Base Valuation of Land Acquisition for Land Units Affected by the Route /Alternative 2/

№	Alternative-2	Number of land units	Area (sq.m)	Land acquisition cost (million MNT)
1	Route-2	62	28,532	1,628
2	Transformer substation	7	4,375	560
Total		**69**	**32,907**	**2,188**

[68]Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 131
[69] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 132

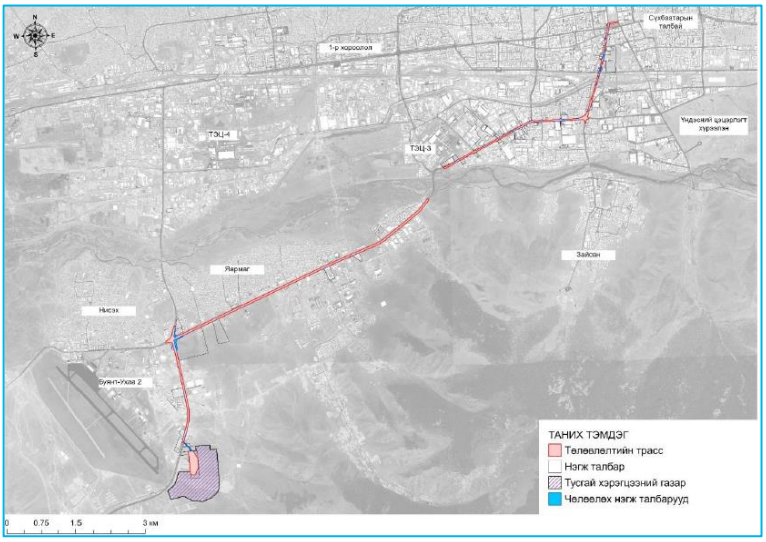


Figure 3-45 Land Acquisition /Alternative-2/

Alternative 3

Land acquisition for Alternative 3 was calculated with widths of 38 meters along Olziit Road, 42 meters along Naadamchid Road, 28 meters along Chinggis Avenue, and 7 meters along Peace Avenue.

The base valuation for land acquisition of 29,693 sq.m across 58 land units affected by the route is 2.3 billion MNT. The valuation for 4,375 sq.m across 7 land units affected by the transformer substation location is 0.56 billion MNT, bringing the total land acquisition compensation to 2.9 billion MNT[70].

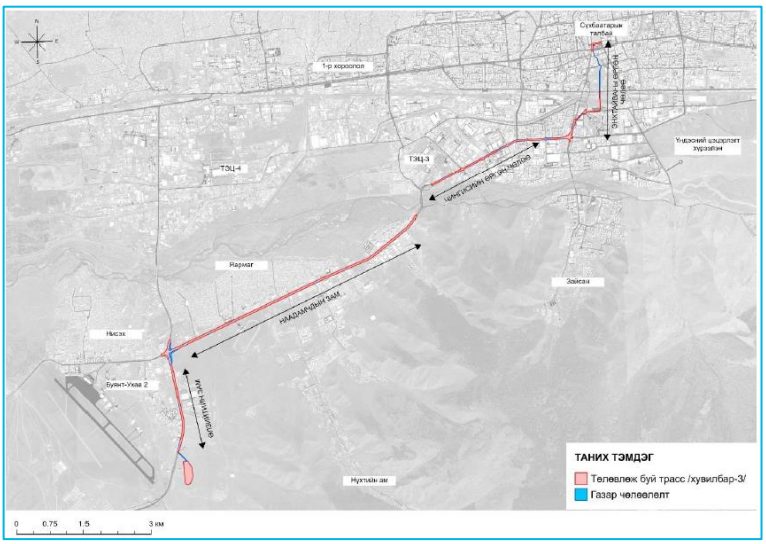


Figure 3-46 Land Acquisition /Alternative-3/

Table 3-10 Base Valuation of Land Acquisition for Land Units Affected by the Route /Alternative-3/

№	Alternative-3	Number of land units	Area (sq.m)	Land acquisition cost (million MNT)
1	Route 3	58	29,693	2,302
2	Transformer substation	7	4,375	560
Total		**65**	**34,068**	**2,862**

[70] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 133

Alternative 4

Land acquisition for Alternative 4 was calculated with widths of 38 meters along Olziit Road, 42 meters along Naadamchid Road, 28 meters along Chinggis Avenue, and 7 meters along Peace Avenue.

The base valuation for land acquisition of 29,790 sq.m across 58 land units affected by the route is 1.25 billion MNT. The valuation for 4,375 sq.m across 7 land units affected by the transformer substation location is 0.56 billion MNT, bringing the total land acquisition compensation to 1.8 billion MNT[71].

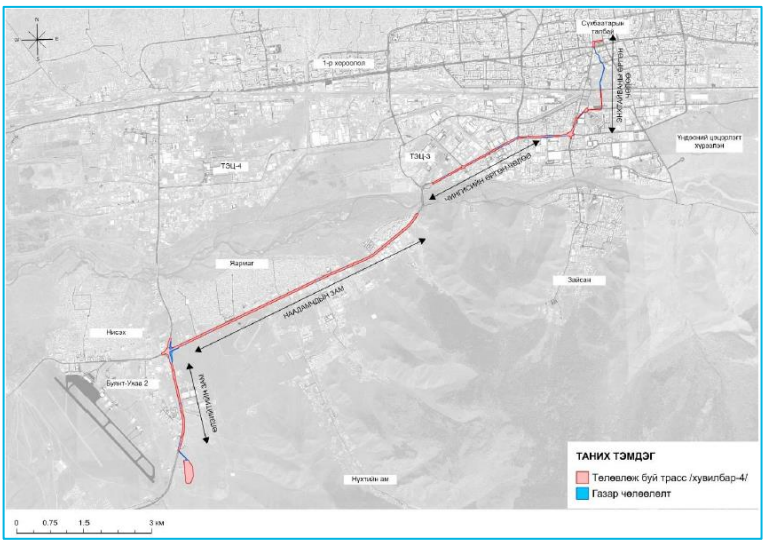


Figure 3-47 Land Acquisition /Alternative- 4/

Table 3-11 Base Valuation of Land Acquisition for Land Units Affected by the Route /Alternative-4/

№	Alternative 4	Number of land units	Area (sq.m)	Land aquisition cost (million MNT)
1	Route-4	58	29,790	1,254
2	Transformer substation	7	4,375	560
Total		65	34,165	1,814

Alternative 5

Land acquisition for Alternative 5 was calculated with widths of 38 meters along Olziit Road, 42 meters along Naadamchid Road, 28 meters along Chinggis Avenue, and 7 meters along Peace Avenue.

The base valuation for land acquisition of 29,291 sq.m across 59 land units affected by the route is 1.23 billion MNT. The valuation for 4,375 sq.m across 7 land units affected by the transformer substation location is 0.56 billion MNT, bringing the total land acquisition compensation to 1.8 billion MNT[72].

[71] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 134
[72] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 134

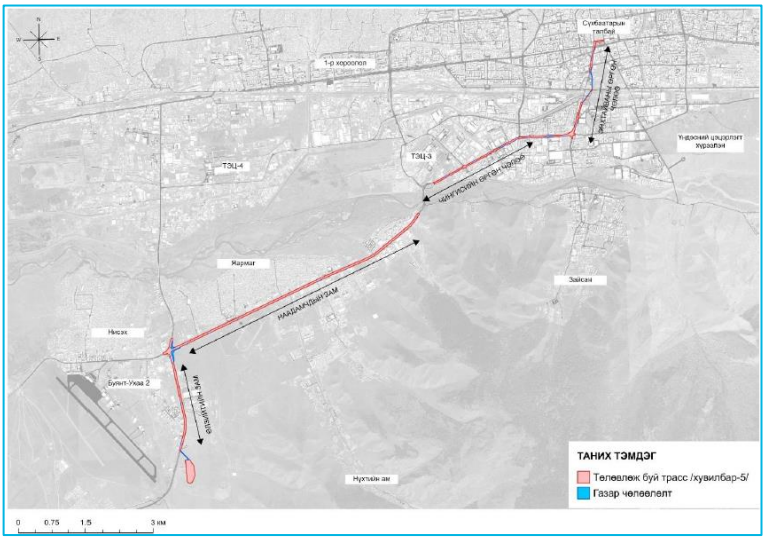


Figure 3-48 Land Acquisition /Alternative-5 /

Table 3-12 Base Valuation of Land Acquisition for Land Units Affected by the Route /Alternative 5 /

№	Alternative 5	Number of Land Units	Area (sq.m)	Land aquisition cost (million MNT)
1	Route 5	59	29291	1,232
2	Transformer substation	7	4,375	560
Total		**66**	**33,666**	**1,792**

Alternative 6

Land acquisition for Alternative 6 was calculated with widths of 58 meters along Olziit Road, 42 meters along Naadamchid Road, 28 meters along Chinggis Avenue, and 35 meters along Peace Avenue.

The base valuation for land acquisition of 41,663 sq.m across 73 land units affected by the route is 3.47 billion MNT. The valuation for 4,375 sq.m across 7 land units affected by the transformer substation location is 0.56 billion MNT, bringing the total land acquisition compensation to 4.0 billion MNT.

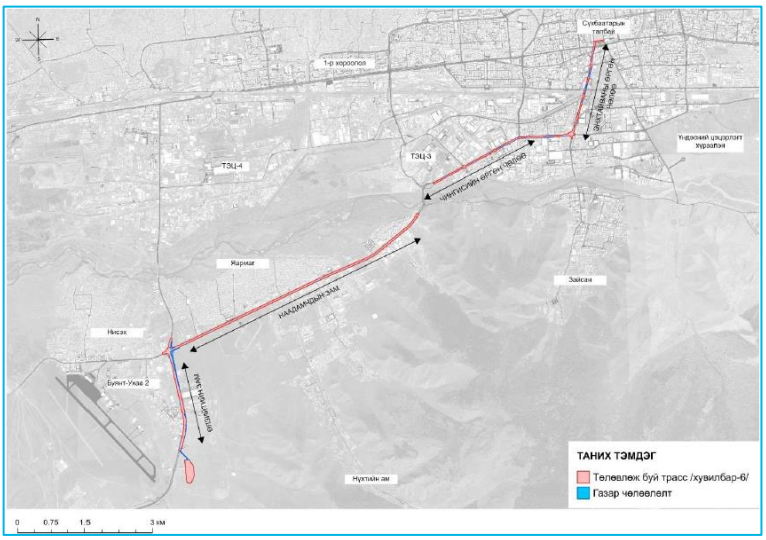


Figure 3-49 Land Acquisition /Alternative-6 /

Table 3-13 Base Valuation of Land Acquisition for Land Units Affected by the Route /Alternative-6 /

№	Alternative 6	Number of land units	Area (sq.m)	Land acquisition cost (million MNT)
1	Route-6	73	41,663	3,468
2	Transformer substation	7	4,375	560

№	Alternative 6	Number of land units	Area (sq.m)	Land acquisition cost (million MNT)
Total		**80**	**46,038**	**4,028**

Alternative 7

Land acquisition for Alternative 7 was calculated with widths of 42 meters along Naadamchid Road, 28 meters along Chinggis Avenue, and 35 meters along Peace Avenue.

The base valuation for land acquisition of 17,904 sq.m across 59 land units affected by the route is 1.42 billion MNT. The valuation for 4,375 sq.m across 7 land units affected by the transformer substation location is 0.56 billion MNT, bringing the total land acquisition compensation to 2.0 billion MNT.

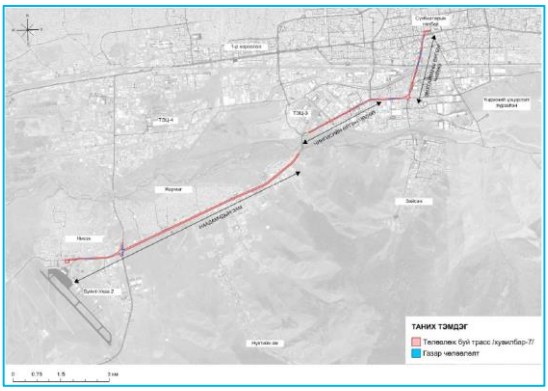


Figure 3-50 Land Acquisition /Alternative-6 /

Table 3-14 Base Valuation of Land Acquisition for Land Units Affected by the Route /Alternative-7/

№	Alternative 7	Number od land units	Area (sq.m)	Land acquisition cost (million MNT)
1	Route 7	59	17,904	1,418
2	Transformer substation	7	4,375	560
Total		**66**	**22,279**	**1,978**

3.7 Economic and Financial Analysis

Total estimated budget. The total investment required for the implementation of the project is estimated at USD 348.15 million. The budget is composed of five main work packages, engineering utility relocation, and land acquisition, as well as additional costs including 2% for client supervision, 8% for contractor management, 3% for detailed work cost and contingency costs for unforeseen works.

Table 3-15 Investment Summary

№		Definition	Cost Calculation	Percentage
Package-1	1	Track Infrastructure Construction Work	102,433,439	38%
	1.1	Substructure Work	38,361,096	14%
	1.2	Superstructure Work	64,072,344	24%
Package-2	2	Signaling and Communication Work	14,123,200	5%
	2.1	Signaling System Installation	14,123,200	5%
Package-3	3	Power Supply Work	38,321,578	14%
	3.1	Power supply Installation	38,321,578	14%
Package-4	4	Station and Depot Building Facilities	21,820,497	8%
	4.1	Depot	19,676,062	7%
	4.2	Station	2,144,435	1%
Total Construction Work /1+2+3+4/			171,209,467	66%
Package-5	5	Rolling Stock and Maintenance Equipment	73,575,000	27%
	5.1	Rolling Stock	63,000,000	23%
	5.2	Maintenance Equipment	10,575,000	4%
	6	**Land Acquisition Cost**	19,796,605	7%
Total /1+2+3+4+5+6/			270,070,320	100%

№		Definition	Cost Calculation	Percentage
	7	Client Supervision Cost 2%	5,401,406	
	8	Contractor Management Cost 8%	20,021,897	
	9	Detailed design and DEIA 3%	7,508,211	
	10	Contingency Cost 5%	13,503,516	
Subtotal			38,973,911	
VAT 10%			29,879,998	
TOTAL INVESTMENT			328,679,982	

3.8 Overall Project Duration

The total project duration is 25 months. The project work sequence consists of multiple activities including construction preparation work, land acquisition, tram track, stations, buildings, power supply, automation systems, transport management systems, rolling stock delivery, transport equipment installation, and testing and adjustment. The schedule is defined as follows:

Table 3-16 Construction Work Plan Overview

Working Section	Activity Name	Duration
1. Construction Preparation Work	Engineering surveys, road line relocation, utility line relocation along the route, temporary bridge construction, site clearance.	3 month
2. Tram Track Construction	Railway installation, concrete foundation installation, installation of rails and crossovers.	15 month
3. Power Supply Work	Substation, overhead contact line and underground cable installation, high voltage line installation, tunnel construction.	15 month
4. Signaling and Communication Systems Installation	Transport control system, traffic lights, camera system, automatic blocking system, and fiber optic cable installation.	8 month
5. Building Structure	Management building, maintenance building, tram stations, office, security building, outdoor area, parking lot.	15 month
6. Rolling Stock and Maintenance Equipment	Delivery of trams, maintenance vehicles, and maintenance equipment.	11 month
7. Material Supply	Purchase, transport, and delivery of construction materials and equipment to the construction site.	Throughout the Project

3.9 Summaries of Tram Track Construction Activities

Track construction preparatory work includes engineering surveys, road removal, relocation of utilities along the route, temporary bridge construction, and site clearance. This will be followed by tram track installation, concrete foundation installation, and adjustment of rails and crossovers. This work will take 15 months to complete. Tram track construction requires very detailed organization and multi-stage operations. It begins with preparatory work, engineering surveys, utility relocation along the route, temporary bridge construction, and site clearance, followed by track installation, concrete foundation installation, and installation of rails and crossovers. This entire process must be completed within 15 months and can be divied into following work types as follows:

Engineering Survey Work

1. Engineering Survey Work
    a. Technical studies: Conduct detailed engineering studies to examine geological, hydrogeological, and weather conditions at the project site before earthwork and track installation.
    b. Ground analysis: Study soil conditions, drainage requirements, and cross-sectional and longitudinal alignment plans on the land where the tram track will be installed to meet engineering standards.
2. Road Removal and Utility Relocation
    a. Road removal: Temporarily close existing roads, remove pavement and asphalt, and relocate obstacles interfering with road construction.

   b. Utility relocation: Relocate high and low voltage power lines, communication cables, water supply lines, internet and TV lines in the area where the tram track will be installed, and construct temporary bridges if necessary.
3. Temporary Bridge Construction
   a. Bridge construction plan: Develop a temporary bridge construction plan where required in the tram track environment. This is necessary to maintain continuous vehicular and public transport operations.
   b. Bridge assembly: Install bridge support columns, structural components, and manage associated line flow.
4. Site Clearance
   a. Cleaning work: Prepare the construction site by removing waste, vegetation, stones, and other obstacles.
   b. Detailed analysis: Site cleaning work focuses on the track area and includes checks of the earthwork environment to prevent any risks.
5. Tram Track Installation
   a. Railway foundation and installation: The installation foundation must be prepared before installing the tram tracks. Track installation includes creating concrete foundations, preparing bridges, tunnels, and drainage facilities of appropriate dimensions, and monitoring the track structure.
   b. Concrete foundation laying: Create the main foundation of the track and position the concrete base. This is essential for track stability and long-term operation.
6. Installation of Rails and Crossovers
   a. Rail installation: Install rails on the concrete foundation. The rails must be perfectly sized to ensure safe tram movement. Rails will need to be welded and connected.
   b. Crossover installation: Install and adjust crossovers. Crossovers play an important role in allowing both large and small trams to move continuously.
7. Drainage Channel Installation
   a. Drainage system: Install drainage channels and pump systems along the tram track. The purpose is to prevent water accumulation around the track and ensure successful maintenance operations.
8. Welding Work
   a. Rail connection: Welding work is required during rail connection and installation. Welding work is important to prevent track damage and defects.
9. Adjustment and Testing
   a. Track adjustment: Check and adjust the size, angle, height, and configuration of the track area as needed.
   b. Testing: Test the complete tram track after rail installation. Safety requirements must be met for tram movement.

Power Supply Work

Power supply work is a fundamental component of the tram system and is essential for the continuous, safe operation of trams. Power supply work involves implementing various engineering solutions and is carried out in multiple stages to fully execute not only the configuration of the tram track but also its power supply. The following breakdown details specific areas of focus:

1. Power Line Installation
   a. Line installation preparation: Organize earthwork, foundation preparation, and line installation direction for power lines. Specifically check the area for high voltage line installation, speed limits, and safety requirements.
   b. High voltage line installation: Successfully install high voltage lines used for tram transport. The type and capacity of the line must meet the power consumption of tram movement. Also, install high voltage lines consistently and safely to ensure power performance.
2. Substation Installation
   a. Determine substation location: Plan substation locations and all necessary equipment to meet the power requirements of the tram network.

   b. Substation installation: Install substations for voltage reduction, distribution, and safe tram movement. Install substation equipment and connect associated engineering lines and supplies.
   c. Voltage distribution system: Install control and protection systems for power distribution, transmission, temporary stoppage, and reserve.
3. Overhead Contact Line System (OCLS) and Power Transmission Control System (PTCS) Installation
   a. OCLS installation: Install an automated power transmission system to automate power distribution and tram movement. This system is responsible for controlling, detecting, stopping, and correcting faults in tram power supply.
   b. PTCS installation: Install a power transmission control system designed to manage control of the power transmission system, maintain power levels, and monitor power loss and safety. The system monitors power consumption and makes automatic adjustments.
4. High Voltage Line Installation
   a. High voltage line construction: High voltage lines are responsible for concentrating power supply for tram transportation and maintaining normal operations. High voltage lines affect the consistency of power and quality of service over a wide range.
   b. Line operational safety: Position high voltage lines and regularly check all connections and isolation devices. Also install protective coverings to prevent external environmental influences.
5. Tunnel Construction Work
   a. Tunnel construction: Tunnel construction may be necessary to protect tram tracks and power transmission lines. Tunnels serve to ensure safe operation of lines and protection from environmental factors.
   b. Tunnel protection: After the installation of lines and other equipment in the tunnel, the tunnel must be fully equipped with walls, doors, and control systems to protect power equipment.
6. Installation Technologies
   a. Technological recommendations and testing: Follow technological recommendations for installing all power transmission equipment including power lines, substations, OCLS, and PTCS, and conduct necessary testing. Test to ensure user safety and generate the required capacity.
7. Power System Monitoring
   a. System monitoring: Monitoring of all power supply operations is the basis for successful, safe operation. The monitoring system is responsible for keeping power levels within permissible ranges and adjusting voltage fluctuations and consumption levels.
   b. Automation of monitoring: Ensure full operation of systems to automate, monitor, detect, and resolve errors in the power supply process.

Signaling and Communication Facility Work

Transport control system, traffic lights, camera system, automatic blocking system, and fiber optic cable installation will be done within 8 months. Signaling and communication work plays a crucial role in ensuring the safe operation of the tram system, regulating traffic flow, and ensuring the safety of operating trams and vehicles. This section requires the installation of various high-tech systems, which are important for the successful implementation and safety of the project.

1. Transport Control System
   a. System installation: The transport control system is responsible for regulating tram movement, monitoring safety, and optimally adjusting tram loads. This system helps ensure safe, responsible transportation and improves connectivity between new tram lines and other vehicles.
   b. Technical installation: Connect the control system with related components and link all system communications. Pay attention to technical connection and integration.

   c. Monitoring system: The transport control system is responsible for sending information to drivers and the tram control center, determining the direction of tram movement, and improving safety monitoring.
2. Traffic Lights
   a. Traffic light installation: Install traffic lights and traffic signals along the tram route, in the middle of roads, and in common areas. This plays an important role in ensuring coordination between tram movement and traffic lights.
   b. Light system monitoring: Monitor the traffic light system and manage traffic light updates and congestion prevention activities.
   c. Energy consumption: Optimally regulate and efficiently use the energy consumption of the traffic light system.
3. Camera System
   a. Camera installation: Position camera systems along the tram route, at bus stops, parking areas, and along main roads. The camera system is responsible for monitoring tram safety, issuing violation alerts, and checking camera recordings.
   b. System integration: Directly transmit camera recordings and information to the control center and monitor the effectiveness of the camera system.
   c. Audio response system: The camera system is responsible for transmitting not only video information but also real information about activities and conditions at a given location.
4. Automatic Blocking System
   a. Automatic blocking system installation: Install an automatic blocking system to monitor the movement of trams and other vehicles on the tram track and ensure safety.
   b. Protection system configuration: If a dangerous condition occurs, the system automatically stops or sends some kind of warning. This plays an important role in increasing system safety.
   c. System test and trials: Thoroughly check the operation of the automatic blocking system and make necessary adjustments.
5. Fiber Optic Cable Installation
   a. Fiber optic cable installation: Install fiber optic cable designed to support all communication and information transmission of the tram system. Fiber optic cable offers high speed, reliability, and broadband capacity, enabling fast, lossless transmission of information for all tram control systems.
   b. Fiber optic cable connection: Fiber optic cable is responsible for transmitting information between all tram centers and their local connections. High requirements are placed on cable connection installation.
   c. Fiber optic cable testing and configuration: After fiber optic cable and connection combination work is completed, check that all connections are working correctly.
6. System Monitoring and Testing
   a. Testing operations: After installing signaling and communication systems, check the operation of all systems and conduct appropriate tests. The testing phase is important for ensuring system safety and configuring safe operation and normal operational settings.
   b. System monitoring: All signaling, camera systems, and communication information are monitored through the control center and monitoring system.

Building Construction Work

The project's building construction work includes construction of management buildings, maintenance buildings, tram stations, offices, security buildings, outdoor areas, and parking lots. This work will be completed within 15 months. Building construction work for the project is interconnected with other parts of the tram system and is important for ensuring transport, service, maintenance structure, operational safety, and comfort. Building construction work as a whole is a key part of improving citizens' quality of life and supporting tram system services and operations. The following activities will be carried out when performing this work:

1. Management Building
    a. Organization, design: The management building should serve as the main center for project management, monitoring, establishing communication, and conducting management activities, as well as storing all service and necessary equipment.
    b. Building structure: The basic structure of the management building consists of the following parts:
        i. Management room, conference hall: Designed for organizing project management, management team, and communication activities.
        ii. Public and internal meetings will be organized in this hall.
        iii. Employee workplaces: Workplaces designed for performing structural cost, calculation, performance monitoring, and other tasks.
    c. Building materials: Materials used in the management building structure must be selected to be durable, ensure safety, and be energy efficient.
2. Maintenance Building
    a. Maintenance center: The maintenance building will be a center for repairing and adjusting all components, rolling stock, and equipment of the tram system, and the following activities will be carried out:
        i. Maintenance hall: A hall for technical service of trams and maintenance vehicles.
        ii. Equipment storage: Storage facility for tools, equipment, and spare parts needed for repairs.
    b. Building structure: The maintenance building must have a structure suitable for ensuring safety and repairing tram components. This building must be fully equipped with ventilation, heating, electrical supply, water supply, etc.
3. Tram Stations
    a. Tram station construction: Tram stations are areas dedicated to passenger service, supporting tram arrival and departure activities, and consisting of the following parts:
        i. Station building: Passenger rest, information section, ticket purchase section.
        ii. Outdoor area: The tram station will have an outdoor area that makes it easy and safe for passengers to board and alight from trams, as well as offering economic efficiency.
        iii. Lighting: Safe lighting for passengers, maintaining a suitable environment.
4. Office Building
    a. Office space: The office building offers daily workplace for project employees and creates space for activities related to project documentation and requirements.
    b. Working environment: The office building must provide public use and private work spaces, computer rooms, and archives.
    c. Equipment, power supply: The office building must be equipped with electricity, ventilation, internet, and all other necessary conditions.
5. Security Building
    a. Security building: The security building is designed to ensure project safety, monitor and regulate all parts of the tram system.
    b. Structure, building: This building must essentially have personal space for security workers, surveillance cameras, guard posts, call centers, and all equipment necessary to ensure security.
6. Outdoor Area
    a. Safe passenger movement: The outdoor area encompasses many activities to ensure safe passenger travel, pedestrian crossings, road signs, lighting, and green infrastructure.
    b. Parking lot: The organization of parking lots and parking areas around tram stations and buildings will help alleviate waiting times for passengers.
7. Parking Lot
    a. Parking area: Organize parking space for vehicles of passengers using the tram, which must be safe and suitable.

b. Building materials: The parking lot structure must be made of concrete and metal structures to ensure safety and stability, and must be resistant to maintenance and other influences.

8. Outdoor Equipment

a. Outdoor improvement: Work on outdoor improvement of buildings includes creating agriculture, green infrastructure, and green areas. This will have a positive impact on the environment of the tram system and improve the quality of the living environment.

Rolling Stock and Maintenance Equipment

The delivery time for trams, maintenance vehicles, and equipment will be 11 months. The process of delivering, installing trams, maintenance vehicles, and equipment is a critical part of the tram system and directly affects the efficiency, safety of transport operations, and quality of maintenance. Let's examine the activities to be implemented in this section in detail:

1. Tram Rolling Stock:
    a. Tram delivery: The rolling stock of trams will play a crucial role in the successful implementation of the project. Tram vehicles must meet high technology, safety, and economic efficiency requirements. This includes:
        i. Determining tram types: Select tram types that are suitable for the project's needs, capacity, and road conditions. These should include not only transport vehicles but also advanced technological solutions.
        ii. Rolling stock orders: Select and obtain rolling stock from the relevant manufacturer. Supplier selection will be made considering quality, price ratio, and after-sales supply.
        iii. On-site testing: Conduct initial testing and adjustment of tram vehicles. Check that tram components fully comply with all control systems, mechanical and electrical systems.
    b. Rolling stock operation and maintenance:
        i. Technical service program: Develop a regular repair and service program once the tram rolling stock is operational. This includes preventive maintenance, sensor device checks, and mechanical component inspections.
        ii. Establish a repair center: Establish a tram repair service center, supply the center with the necessary equipment, and train operation and maintenance staff.
2. Maintenance Vehicles and Equipment:
    a. Maintenance vehicle delivery: Deliver vehicles designed to ensure normal tram operation, prevent breakdowns, and perform maintenance. Maintenance vehicle types should be capable of performing all types of tram maintenance.
        i. Tram adjustment and repair equipment: Supply equipment necessary during repair work. This includes engines, electrical components, reinforcements, lubrication systems, wheel repair equipment, etc.
        ii. Maintenance vehicle installation: Position maintenance vehicle components at the transport vehicle maintenance center, connect equipment, and check proper operation.
    b. Delivery of other equipment for technical service:
        i. Technical equipment: Deliver special equipment required for tram and repair work. This includes automatic control systems, sensor equipment for checking the durability of tram components, and essential tools for maintenance.
        ii. Measurement and testing: Check the safe operation of technical equipment, test adjustments made during installation.
3. Maintenance Equipment Service:
    a. Maintenance instructions: When using maintenance machines and equipment, provide not only standard settings but also maintenance instructions and technical economic information.

   b. Full operational control: Continuously monitor maintenance machines and equipment and perform necessary maintenance.
   c. On-site practical control: Check maintenance machines and equipment in practical conditions, make necessary adjustments, and prevent damage.
4. Delivery Configuration and Testing:
   a. Delivery and acceptance: After delivery of trams and maintenance equipment, receive components, perform installation and adjustment operations. This must be carried out with operational testing and monitoring.
   b. Performance verification: Conduct performance testing and trials of all systems of delivered trams and maintenance vehicles. This inspection will focus on verifying the operation and safety of all technical components with the network.
5. Required Conditions for Rolling Stock and Maintenance Vehicle Service:
   a. Tool and service material supply: Supply essential tools for trams and maintenance vehicles, provide service materials in a timely manner.
   b. Service tool installation: Maintenance workers should be able to use essential tools on rolling stock and maintenance vehicles.

Material Supply

The work of purchasing construction materials and equipment from manufacturers, transporting them to the construction site, and storing them will be organized. Materials must meet size and quality requirements suitable for construction needs. The activities of supplying, transporting, and storing construction materials and equipment play an important role in the successful implementation of the project. The quality and result of construction work depend not only on project planning and management organization but are also directly related to the quality, quantity of materials, and how they are properly organized, transported, and stored.

1. Material Equipment Selection, Ordering:
   a. Selection of construction materials and equipment: Select materials that meet project needs, project quality requirements, and technical requirements. This includes:
      i. Material types: All types of construction materials such as rails, concrete, metal components, infrastructure, electrical equipment, power connections, maintenance tools, etc.
      ii. Technical requirements: Materials must comply with project technical requirements and standards. Quality, durability, economic efficiency, and environmental friendliness are also important.
      iii. Supplier selection: Select suppliers considering product quality, price, delivery time, and basic contract terms.
   b. Placing orders: Place orders with suppliers according to project requirements, technical specifications, and quality requirements. The order should cover all types of materials and equipment.
2. Transportation Processing:
   a. Transportation activities: Organize the transportation of materials and equipment from the factory to the construction site. This serves several important functions:
      i. Transport routes, vehicles: Carefully define transport routes, check the safety of transport vehicles, identify potential obstacles when loading and unloading.
      ii. Transport phases: Transportation includes several phases which are carried out as follows:
         1. Start transporting materials from the factory;
         2. Transport delivered materials to temporary storage locations;
         3. Safely transport to the construction site with precise organization.
   b. Transportation control: Address all issues that need to be monitored during transportation. This includes:
      i. Material quantity and quality checks: Check materials being transported. Record cargo integrity, quantity, quality, and all items during transportation.
      ii. Transportation schedule: Resolve obstacles that may arise during transportation, optimally organize transportation times.

3. Material Storage at Construction Site:
    a. Material storage environment: Proper organization for storing materials and equipment at the construction site is important. Materials arriving at the construction site should have:
        i. Safe storage: Store materials in special environments to protect them from external influences. They should be protected from natural factors such as water, wind, soil, etc.
        ii. Clean, organized storage: Materials should be stored without interference from many elements, in required quantities. This includes organization of storage areas, classification of materials, and storage according to brands.
        iii. Safety: Take storage measures to ensure no danger to human life and health, and ensure material safety.
4. Material Management and Registration:
    a. Material registration: Include all construction materials and equipment in a registry with required information (quantity, brand, supplier name, delivery time). This helps conduct effective material control.
    b. Material distribution: Distribute materials arriving at the construction site to appropriate sections, based on the activity start plan.
    c. Material disclosure: Quickly and efficiently disclose and distribute materials needed for use.
5. Proper Material Use and Control:
    a. Material usage control: Monitor the usage of materials at the construction site. These materials should be correctly calculated and fully utilized.
    b. Usage report: Generate records and reports on material usage, storage, and transportation.
6. Material Inspection and Issue Response:
    a. Conduct inspections: Check the quality, quantity, and type of materials being transported and arriving at the construction site.
    b. Response: Resolve any issues with materials after inspection, submit service requests.
7. Issues That May Affect the Project:
    a. Transportation delays: There may be delays during transportation, slow cargo delivery, violation of transportation times. This can directly affect construction work and risk delaying timelines.
    b. Excessive material storage: Storing too many materials at the construction site can cause problems with site safety, reduced turnover, and obstruction of worker movement.
    c. Material quality degradation: Materials may deteriorate if not regularly checked, especially when stored in natural conditions.

4. Environmental baseline

4.1 Topography and landscape

The location of the proposed “The Ulaanbaatar Public Transport (Light Rail Transit-LRT) from General Archives to Sukhbaatar Square” project would be located at 15 khoroos in Sukhbaatar and Khan-Uul districts of Ulaanbaatar city. The elevation of the project area ranges from 1,173 to 2,256 meters above sea level (see Figure 4-1). The highest point is the Tsetseegun of Bogd Khan Mountain summit, and the lowest area is the alluvial valley of the Tuul River.

4.2 Climate

According to the meteorological data[73] has been collected from meteorological stations, including the Buyant-Ukhaa and Ulaanbaatar stations. The location of proposed “The Ulaanbaatar Public Transport (Light Rail Transit-LRT) from General Archives to Sukhbaatar Square” project would be located at Sukhbaatar and Khan-Uul districts in Ulaanbaatar City and as shown in Figure 4-1, the microclimate of the AoI is described and summarized based on above mentioned meteorological data collected over the last 18 years (e.g., 2005–2023).

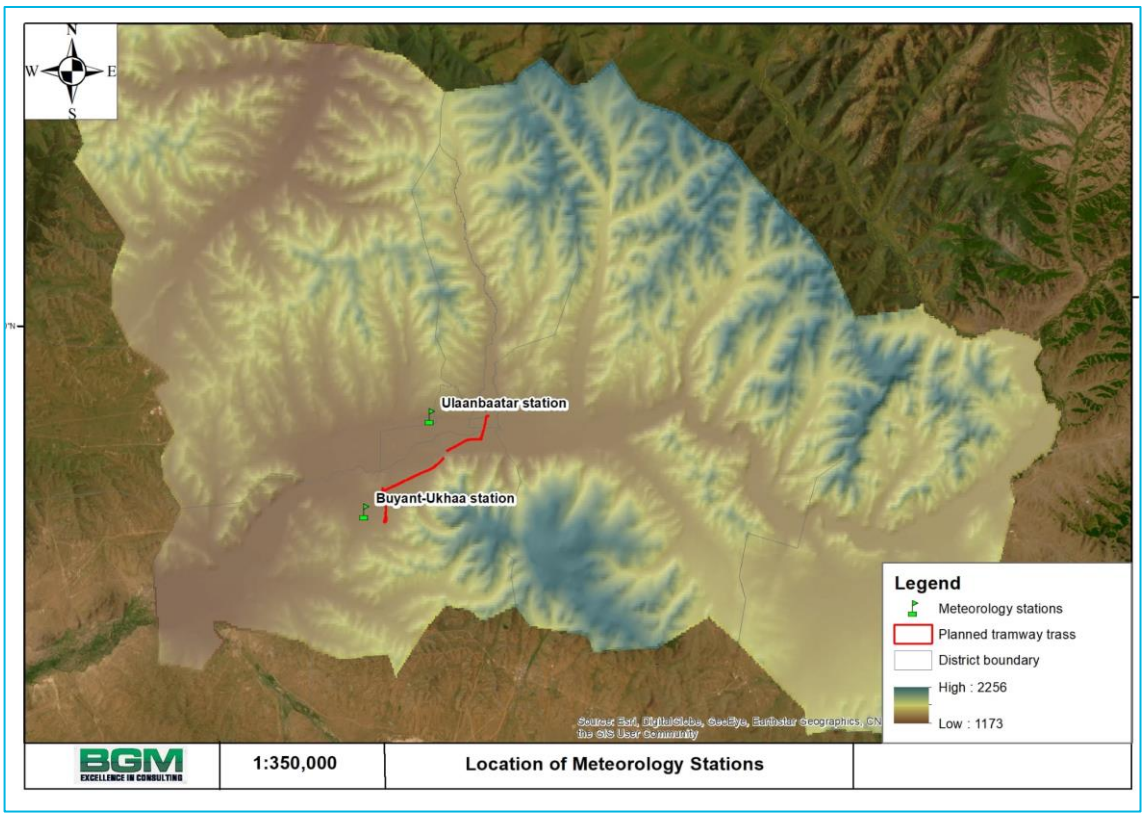


Figure 4-1 Location of Nearby Meteorological Station and elevation of the project area

[73] National Agency Meteorology and the Environmental Monitoring

4.3 Air Temperature

As shown in Figure 4-2, based on meteorological data recorded over the last two decades (2005–2023), the highest average annual temperatures were observed in 2008 and 2016. In 2023, the long-term average air temperature recorded was 0.6°C at Buyant-Ukhaa station, 1.1°C at Ulaanbaatar station. A comparison of the locations of these two weather stations shows that the highest average air temperature occurs in the area around the Ulaanbaatar station, as shown in Figure 4-2.

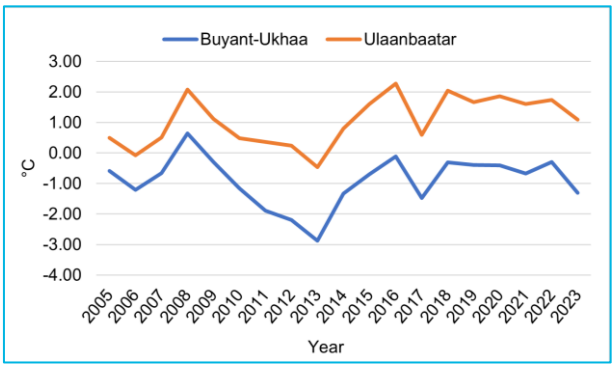


Figure 4-2 Annual Mean Air Temperature (°C), 2005-2023

The long-term monthly fluctuations in average air temperature at the stations is shown in Table 4-1.

Table 4-1 Annual Mean Air Temperature (°C), 2005-2023

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Ulaanbaatar	-23.2	-19.7	-10.4	-0.1	6.2	12.4	15.2	13.0	7.1	-1.4	-12.9	-20.9
Buyant-Ukhaa	-20.2	-16.2	-6.0	3.7	10.3	17.0	19.6	17.2	11	2.2	-9.1	-18.0

The seasonal fluctuations of the average air temperature over the past 18 years at 2 stations are summarized as shown in Table 4-2.

- Buyant-Ukhaa station: the average air temperature was 17.22°C during the summer, -0.62°C during fall, -21.72°C in winter, and 1.14°C in spring.
- Ulaanbaatar station: the average air temperature was 17.9°C during the summer, 1.47°C during fall, -18.14°C in winter, and 2.67°C in spring.

Table 4-2 Annual Mean Air Temperature (˚C), 2005-2023

Station	Year	Winter	Spring	Summer	Fall
Buyant-Ukhaa	2005	-20.55	0.71	18.11	-0.74
	2006	-24.64	0.24	18.62	0.35
	2007	-20.41	-0.46	17.23	0.62
	2008	-18.11	0.94	19.61	-0.12
	2009	-22.73	2.44	18.11	0.81
	2010	-22.36	2.60	17.13	-2.42
	2011	-24.03	-1.88	17.65	0.25
	2012	-23.71	-0.73	16.91	-1.55
	2013	-26.39	0.30	16.05	-1.89
	2014	-22.29	0.80	15.86	-0.20
	2015	-20.92	1.81	15.82	0.06
	2016	-18.19	0.37	17.68	-0.63
	2017	-22.62	1.44	17.45	-2.41
	2018	-20.62	2.63	18.07	-1.67
	2019	-23.05	3.88	17.33	-0.18
	2020	-20.27	1.26	16.84	0.18
	2021	-20.67	2.01	16.59	-0.72
	2022	-19.33	1.94	16.13	-0.21
	2023	-21.78	1.34	16.08	-1.28

Station	Year	Winter	Spring	Summer	Fall
	Average	**-21.72**	**1.14**	**17.22**	**-0.62**
Ulaanbaatar	2005	-17.64	1.30	17.58	0.65
	2006	-21.64	0.89	18.20	1.67
	2007	-17.63	0.43	16.90	1.95
	2008	-15.11	2.05	19.42	1.76
	2009	-19.75	3.65	18.36	2.03
	2010	-19.28	3.90	17.50	-0.55
	2011	-20.67	-0.26	19.40	2.51
	2012	-19.89	1.43	18.01	1.15
	2013	-22.27	2.17	17.01	0.85
	2014	-18.22	2.31	16.85	1.81
	2015	-17.18	3.22	17.00	2.98
	2016	-14.23	2.61	18.61	1.79
	2017	-18.36	2.90	18.32	-0.68
	2018	-16.31	4.51	19.13	0.51
	2019	-19.37	5.49	18.31	1.82
	2020	-16.76	3.40	17.79	2.64
	2021	-16.93	4.03	17.70	1.54
	2022	-15.70	3.21	17.08	2.10
	2023	-17.74	3.41	17.04	1.33
	Average	**-18.14**	**2.67**	**17.91**	**1.47**

4.4 Sunshine and Solar Radiation

Sunshine and solar radiation distribution vary depending on the geographical and surface location of the area, as well as factors such as latitude, daily sunshine duration, cloud cover, and general weather conditions[74]. As shown in Figure 1-3, the total annual solar radiation in Ulaanbaatar City was 5823.6 mJ/m² in 2019. During the winter months, the cumulative radiation ranges from 170 to 322 mJ/m², whereas in the summer months, it reaches 628 to 747.6 mJ/m², which is approximately twice as much as in winter. This results in significantly higher thermal energy input during summer, contributing to increased warming.

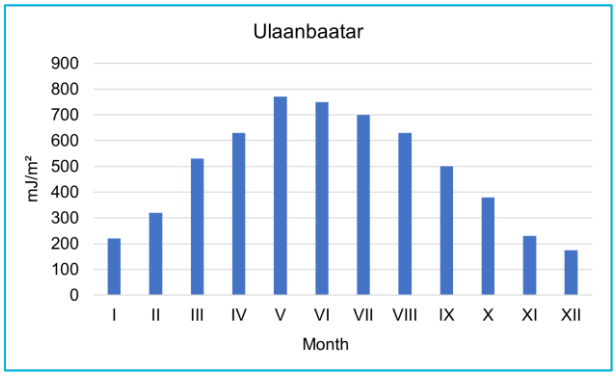


Figure 4-3 Solar Radiation Intensity, Ulaanbaatar Station, 2019

4.5 Humidity

As provided in Figure 4-4, the annual mean relative humidity in Ulaanbaatar between 2005 and 2023 decreased. The annual average relative humidity was 58% at the Ulaanbaatar station and 61.4% at the Buyant-Ukhaa station. Among the stations, the relative humidity in the area around Buyant-Ukhaa is slightly higher compared to that of the Ulaanbaatar station.

[74] http://tsag-agaar.gov.mn/info/atmosphere

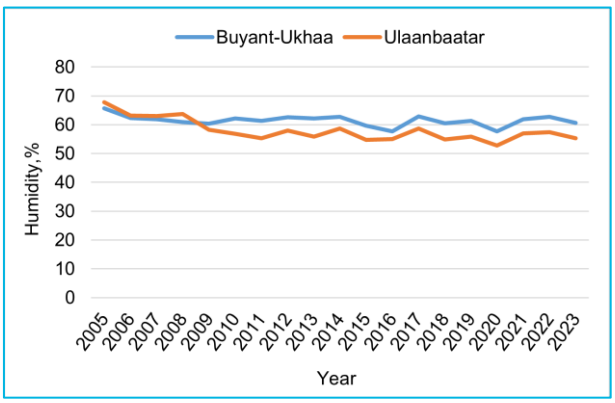


Figure 4-4 Average Annual Relative Humidity, 2005-2023

As shown in Figure 4-5, relative humidity at both stations decreased during the spring season.

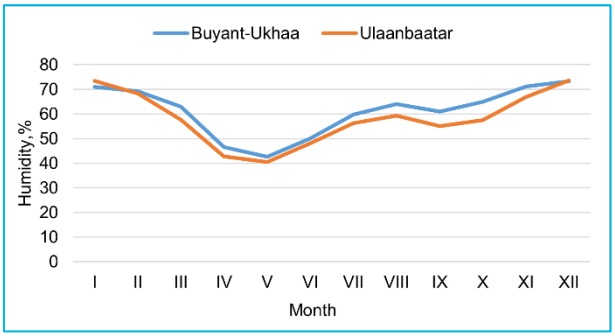


Figure 4-5 Air humidity, monthly changes, average in 2005-2023

The seasonal fluctuations of the average relative humidity at 2 stations are summarized as follows (see Table 4-3):

- Buyant-Ukhaa station: the average relative humidity was 58.43% during the summer, 65.74% during the fall, 71.17% in winter, and 50.76% in spring.
- Ulaanbaatar station: the average relative humidity was 54.17% during the summer, 59.46% during the fall, 71.14% in winter, and 46.31% in spring.

Table 4-3 Annual and Seasonal Fluctuations of Relative Humidity (%), 2005-2023

Station	Year	Winter	Spring	Summer	Autumn
Buyant-Ukhaa	2005	75.62	58.78	56.39	71.91
	2006	73.27	55.86	54.90	65.34
	2007	72.19	48.25	58.27	68.90
	2008	74.19	54.18	50.46	64.75
	2009	69.40	45.62	56.32	70.23
	2010	72.72	47.36	56.44	72.00
	2011	70.61	53.56	55.79	65.18
	2012	74.45	54.42	59.73	62.07
	2013	70.15	49.60	65.79	63.25
	2014	69.85	51.63	62.42	67.04
	2015	68.53	53.64	61.09	55.46
	2016	68.69	47.67	51.79	62.67
	2017	73.00	52.23	58.07	67.99
	2018	72.41	46.87	54.44	68.43
	2019	69.27	48.62	63.12	64.15
	2020	64.21	43.44	61.59	61.25
	2021	70.91	48.49	59.43	63.35
	2022	71.46	51.95	61.26	67.03
	2023	71.28	52.23	62.89	68.17
	Average	71.17	50.76	58.43	65.74
Ulaanbaatar	2005	82.16	61.07	60.72	67.21
	2006	82.56	55.15	54.72	60.64
	2007	78.50	48.78	58.14	66.44

Station	Year	Winter	Spring	Summer	Autumn
	2008	83.40	53.58	52.63	65.12
	2009	76.40	42.43	51.69	62.56
	2010	68.01	42.19	54.44	62.84
	2011	65.86	46.99	50.64	58.04
	2012	71.94	47.82	55.05	57.13
	2013	70.95	43.38	55.68	53.39
	2014	65.90	48.68	58.78	61.02
	2015	66.50	46.65	54.99	50.38
	2016	66.97	45.71	48.99	58.27
	2017	71.19	47.09	53.16	63.18
	2018	68.99	40.98	48.31	61.28
	2019	67.02	42.05	57.69	56.62
	2020	61.36	38.97	56.82	53.47
	2021	66.16	43.61	53.32	57.19
	2022	67.98	41.69	50.59	57.16
	2023	69.82	43.02	52.93	57.82
	Average	71.14	46.31	54.17	59.46

4.6 Precipitation

According to precipitation measurements from the surrounding stations, the Ulaanbaatar station recorded the highest total precipitation in the area. In 2005, the total annual precipitation was 260.7 mm, which gradually increased in the following years, reaching 348.8 mm in 2019 and 290 mm in 2020. However, a slight decrease was observed during the years 2021–2023, as shown in Figure 4-6. The seasonal fluctuations of the average precipitation at 2 stations are summarized as follows:

- The long-term average precipitation recorded at Buyant-Ukhaa station is 259.8 millimeters.
- The long-term average precipitation recorded at Ulaanbaatar Station is 264.9 millimeters.

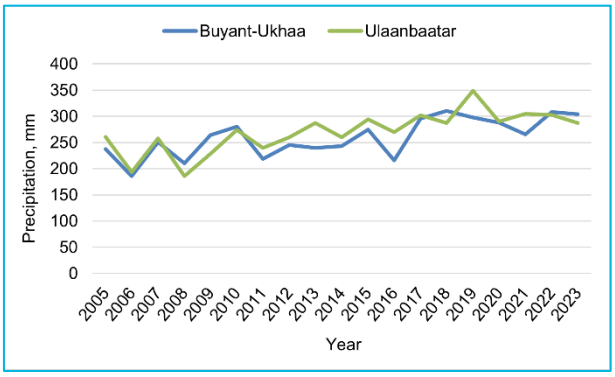


Figure 4-6 Total Annual Precipitation, 2005-2023

The monthly precipitation near the Ulaanbaatar station is highest during the summer months of June, July, and August, reaching up to 800–1440 mm. In contrast, the lowest precipitation occurs in the winter months of January and February, with 30–60 mm, as shown in Figure 4-7.

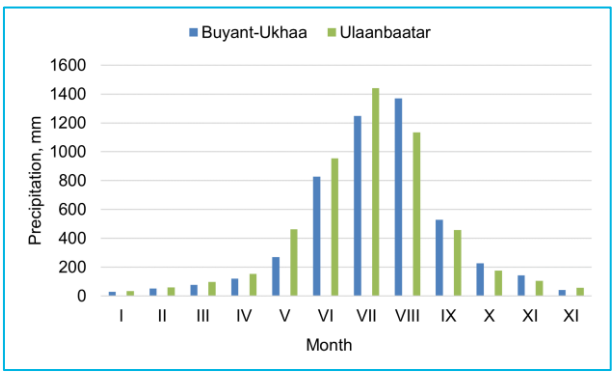


Figure 4-7 Monthly Total Precipitation, 2005-2023

The total precipitation during the summer season around Ulaanbaatar city ranged from 150 to 200 mm between 2005 and 2016, increased to 210 to 250 mm during 2017 to 2020, and was approximately 240 mm in the period 2021 to 2023. In contrast, the lowest precipitation is observed in the winter season, ranging from 2 to 10 mm, while the spring season receives slightly more precipitation than winter, ranging from 20 to 50 mm[75]. The seasonal fluctuations of precipitation around Ulaanbaatar city are shown in Figure 4-8.

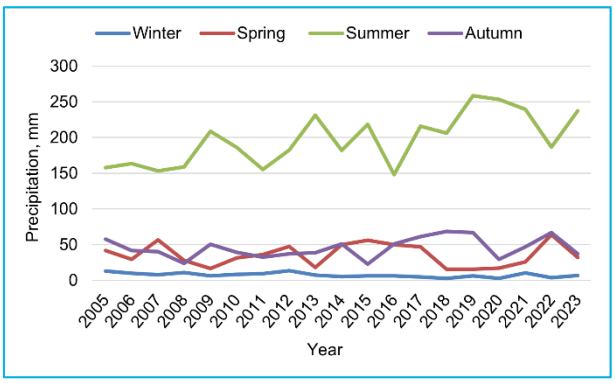
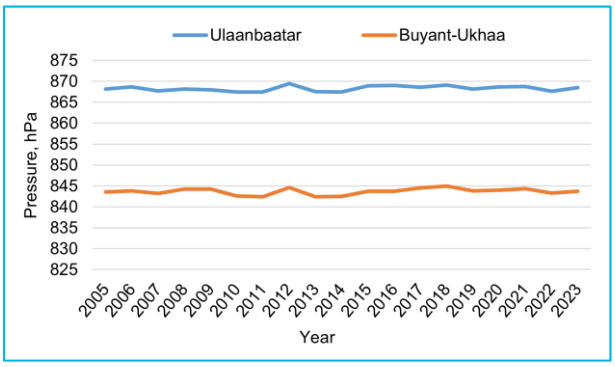


Figure 4-8 Seasonal Total Precipitation, Average of Stations, 2005-2023

4.7 Air Pressure and Wind Regime

Between 2005 and 2023, the annual average air pressure was 844-868 gigapascal at 2 stations (see Figure 4-9). In 2023, the annual average air pressure was 868 gigapascal at the Buyant-Ukhaa station and 844 gigapascal at the Ulaanbaatar station[76].



[75] National Agency Meteorology and the Environmental Monitoring
[76] Climate database. https://eic.mn/climate

Figure 4-9 Average Annual Air Pressure, 2005-2023

Table4-4 Monthly Average Air Pressure (hPa) 2005-2023

Station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Ulaanbaatar	872	870	869	867	865	864	863	866	869	872	871	872
Buyant-Ukhaa	846	844	843	842	841	841	841	843	846	847	845	846

The long-term seasonal average air pressure at the Ulaanbaatar station, where the project will be implemented, is the highest in the winter season, ranging from 869 to 874 hPa. In autumn, the air pressure was between 869 and 872 hPa; in spring, between 865 and 868 hPa; and the lowest values occur in summer, fluctuating between 863 and 866 hPa (see Figure 4-10).

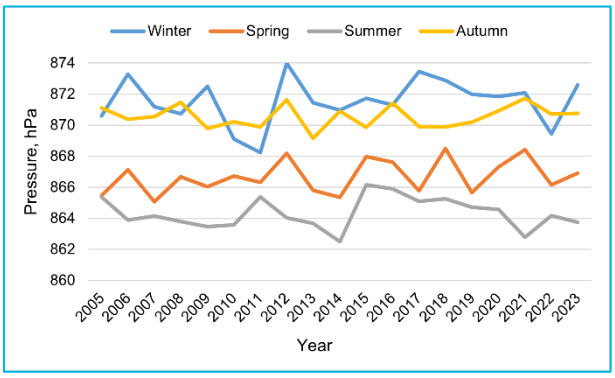


Figure 4-10 Seasonal Average Air Pressure, Ulaanbaatar station, 2005-2023

As shown in Figure 4-11, the long-term average wind velocity around Ulaanbaatar city (2005–2023) ranges between 1.6 and 3.1 m/s. The wind velocity at the Buyant-Ukhaa station is slightly higher compared to that at the Ulaanbaatar station. The long-term average wind velocities recorded at the 2 stations during 2005–2023 are summarized as follows:

- The average annual wind velocity recorded at Buyant-Ukhaa station is 2.7 meters per second.
- The average annual wind velocity recorded at Ulaanbaatar station is 2 meters per second.

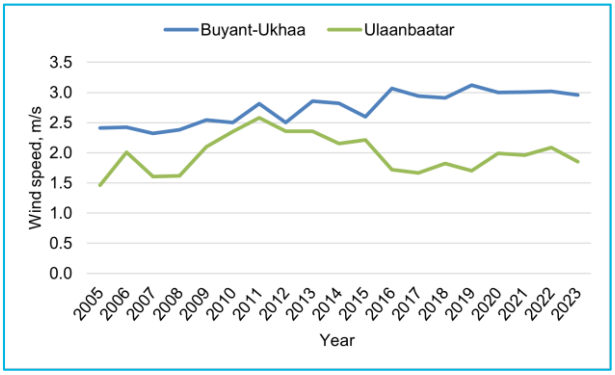


Figure 4-11 Average Annual Wind Velocity, m/s

The wind direction around Ulaanbaatar city varies significantly across different parts of the city as well as by month, season, and day. According to Figure 4-12, during the winter season, north and northeast winds dominate at both Buyant-Ukhaa and Ulaanbaatar stations. Data from 2005 to 2023 indicate that winds from the east-northeast and south prevail during the summer and spring seasons.

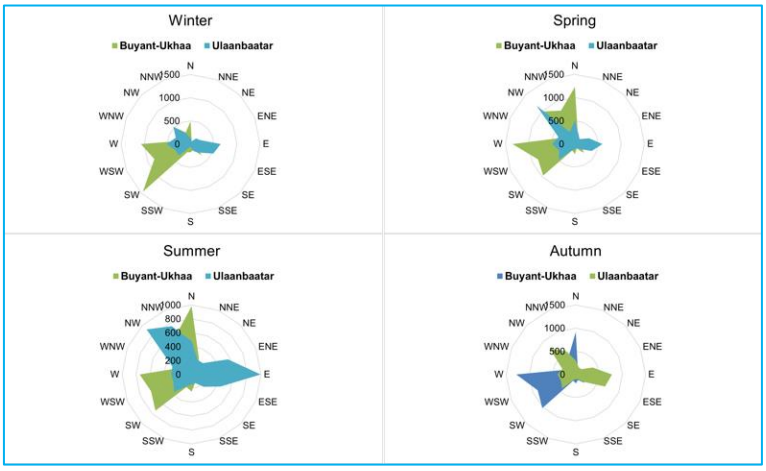


Figure 4-12 Wind Direction Frequency around Ulaanbaatar City, 2005-2023

4.8 Air Quality

Air quality in the Ulaanbaatar city area is continuously monitored at 12 permanent monitoring stations. The stations closest to the project site of "The Ulaanbaatar Public Transport (Light Rail Transit–LRT) from the General Archives to Sukhbaatar Square" are shown in Figure 4-14, which presents the locations of the permanent air quality monitoring stations in Ulaanbaatar.

Air Quality Indicators in Ulaanbaatar City During the Study Period

At the beginning of May, household heating typically ends, resulting in a significant improvement in air quality in Ulaanbaatar city. However, specific sources such as major roads with heavy traffic and industrial activities can still cause localized pollution. Therefore, the air quality conditions on the day of the project site survey were assessed using data from the permanent air quality monitoring stations in Ulaanbaatar.

Sulfur dioxide. Based on the data from 15 active air quality monitoring stations operating throughout Ulaanbaatar city, sulfur dioxide (SO_2) concentrations are notably high during the cold season, particularly in areas surrounding ger districts[77] (Figure 4-13). Sulfur dioxide is a toxic gas that, at elevated levels, can cause symptoms such as shortness of breath. Its primary impacts include respiratory illnesses, tissue damage, and the formation of particulate matter and acid rain (H_2SO_4), which adversely affect human health, the environment, infrastructure, and various social sectors.

[77] National Statistics Office of Mongolia https://www.1212.mn/mn/search/%D0%B0%D0%B3%D0%B0%D0%B0%D1%80%D1%8B%D0%BD%20%D1%87%D0%B0%D0%BD%D0%B0%D1%80

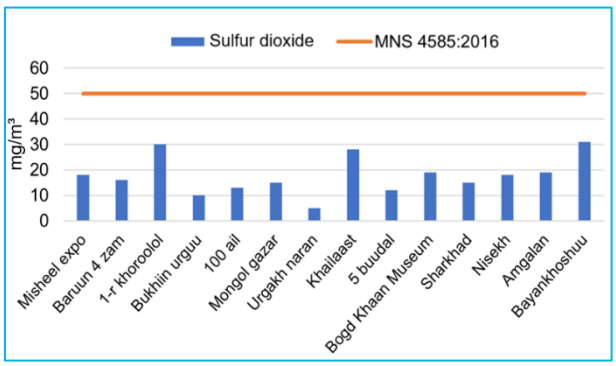
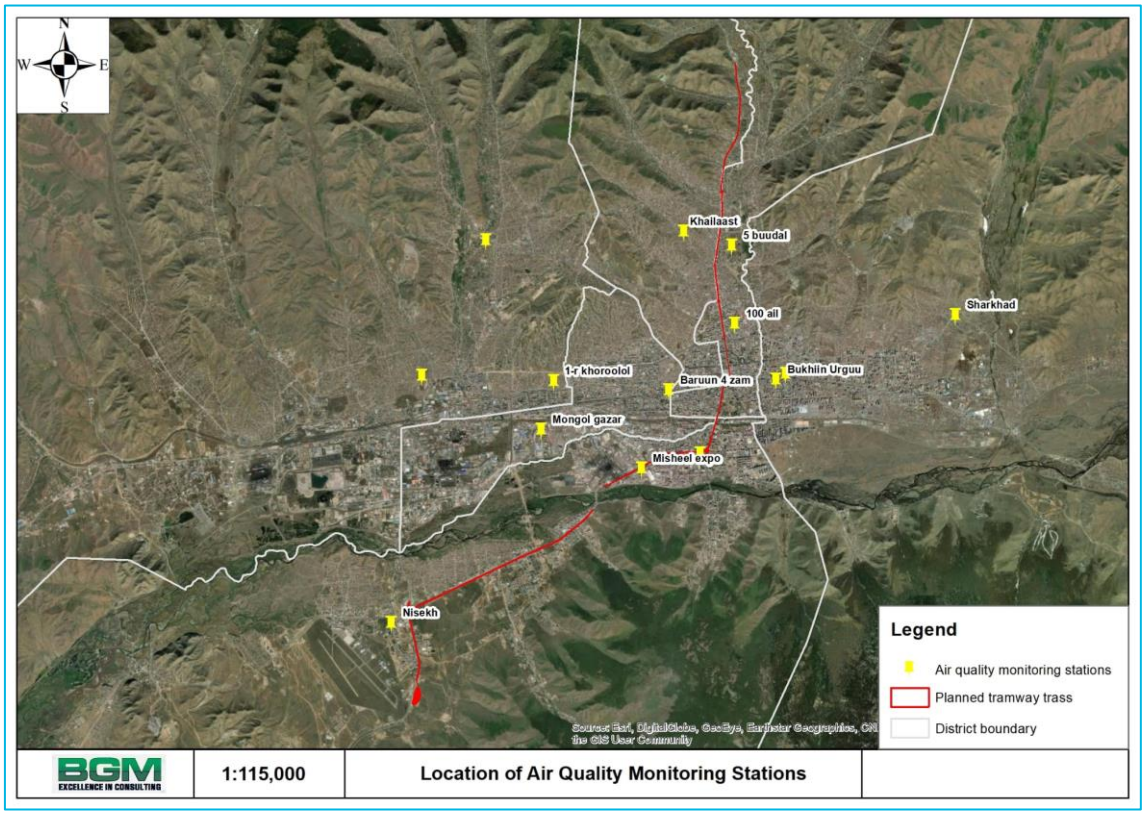


Figure 4-13 Daily average concentration of sulfur dioxide (SO_2) in urban air by air quality monitoring stations

Observed on the measurement data by air quality monitoring station locations, higher concentrations of sulfur dioxide were recorded around the "1-r khoroolol," "Khailaast," and "Bayankhoshuu" stations, indicating that household coal burning had not yet fully ceased in these areas. However, the daily average concentrations of sulfur dioxide in all locations remained below the maximum permissible limit specified in the general technical requirements for ambient air quality, general technical requirements MNS4585: 2016.

Nitrogen dioxide. Nitrogen dioxide (NO_2) is a byproduct of high-temperature combustion, primarily resulting from heat-absorbing reactions during the burning of nitrogen-containing fuels. It is one of the major contributors to ambient air pollution. The main source of this pollutant is all types of motor vehicles, and it adversely affects both human health and the environment, either directly or through the formation of acid rain and ground-level ozone[78].



[78] National Statistics Office of Mongolia https://www.1212.mn/mn/search/%D0%B0%D0%B3%D0%B0%D0%B0%D1%80%D1%8B%D0%BD%20%D1%87%D0%B0%D0%BD%D0%B0%D1%80

Figure 4-14 Location of Air Quality Monitoring Station

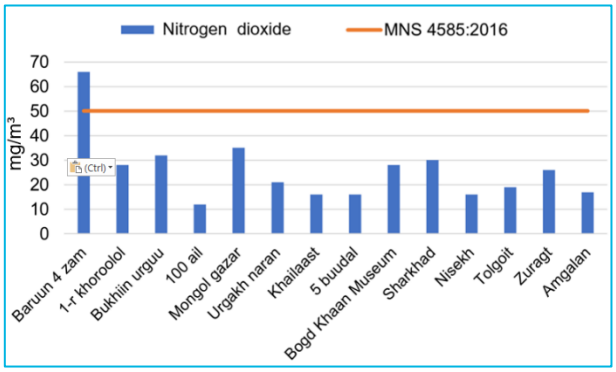


Figure 4-15 Daily average concentration of nitrogen dioxide (NO_2) in urban air by air quality monitoring stations

Based on the monitoring station locations, the concentration of nitrogen dioxide (NO_2) in ambient air was highest around Baruun 4 zam, with a daily average concentration of 66 µg/m³, which is 1.3 times higher than the permissible limit. In contrast, concentrations at other locations remained below the annual permissible limit (see Figure 4-15).

PM_{10}. Within Ulaanbaatar's air quality monitoring network, particulate matter with an aerodynamic diameter of less than 10 microns (PM_{10}) is continuously measured at 15 locations, and particles smaller than 2.5 microns ($PM_{2.5}$) are measured at 11 locations using beta-ray absorption and laser scattering methods. As shown in Figure 4-16, the highest daily average concentration of PM_{10} across the city was recorded near Bayankhoshuu, reaching 65 µg/m³, which is 1.3 times higher than the permissible limit[79].

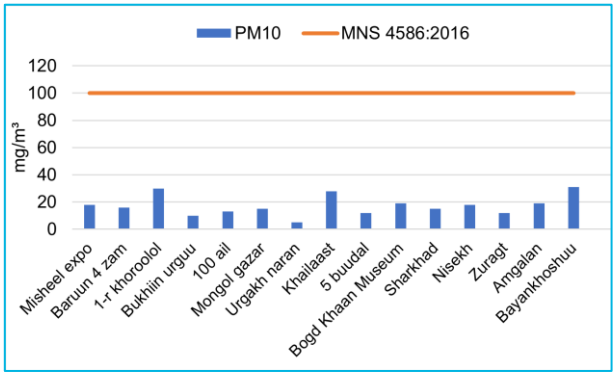


Figure 4-16 Daily average concentration of PM_{10} in urban air by air quality monitoring stations

The monthly 24-hour average concentrations (measured on the 1st day of each month) for the air quality indicators at the project site were compared with the tolerance limits for common air pollutants and the maximum permissible levels of environmental impacts, as specified in the air quality, general technical requirements MNS 4585:2016 standard[80].

[79] National Statistics Office of Mongolia https://www.1212.mn/mn/search/%D0%B0%D0%B3%D0%B0%D0%B0%D1%80%D1%8B%D0%BD%20%D1%87%D0%B0%D0%BD%D0%B0%D1%80

[80] National Statistics Office of Mongolia https://www.1212.mn/mn/search/%D0%B0%D0%B3%D0%B0%D0%B0%D1%80%D1%8B%D0%BD%20%D1%87%D0%B0%D0%BD%D0%B0%D1%80

Within the framework of the project "The Ulaanbaatar Public Transport (Light Rail Transit–LRT) from the General Archives to Sukhbaatar Square," data from the 5 air quality monitoring stations located nearest to the project area—Khailaast, Baruun 4 zam, Misheel expo, Bogd Khaan museum, and Nisekh—were used to develop the following information[81].

As shown in Figure 4-17, the average sulfur dioxide (SO_2) concentrations over the past 5 years (2020–2024) demonstrate seasonal fluctuations. During the peak pollution period—from October to March—sulfur dioxide concentrations were found to be up to 12 times higher than the standard in the Khailaast area and 8 to 10 times higher in the Nisekh area. Exceedances of the permissible limit were observed in most locations during the winter months.

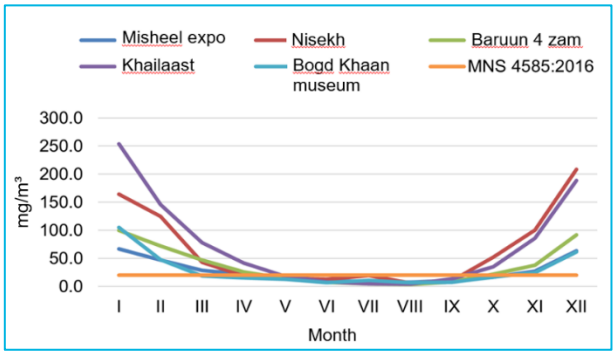


Figure 4-17 Monthly Average Concentration of Sulfur Dioxide (SO_2), 2020-2024

As shown in Figure 4-18, the average concentrations of nitrogen dioxide (NO_2) during the winter months over the period 2020–2024 were found to exceed the air quality general technical requirements MNS4585: 2016 permissible limits at several locations:

- Khailaast area: 49–55 µg/m³, which is 1.4 times higher than the permissible limit;
- Nisekh area: 43–53 µg/m³, or 1.3 times higher than the permissible limit;
- Baruun 4 zam area: 45–48 µg/m³, 1.2 times the permissible level.

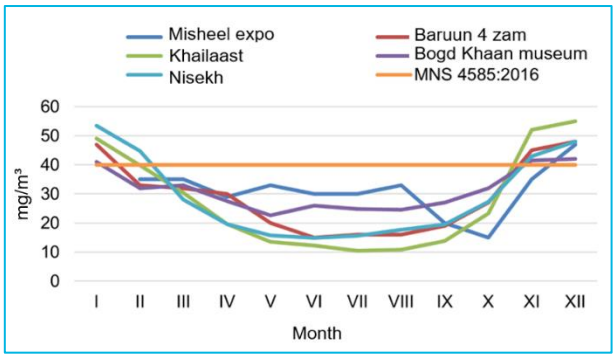


Figure 4-18 Monthly Average Concentration of Nitrogen Dioxide (NO_2), 2020-2024

[81] National Statistics Office of Mongolia https://www.1212.mn/mn/search/%D0%B0%D0%B3%D0%B0%D0%B0%D1%80%D1%8B%D0%BD%20%D1%87%D0%B0%D0%BD%D0%B0%D1%80

According to the air quality standard, the permissible limit for carbon monoxide (CO) concentration is 10,000 µg/m³. As shown in Figure 4-19, no exceedances of this limit were observed in areas near the project site in terms of carbon monoxide concentration.

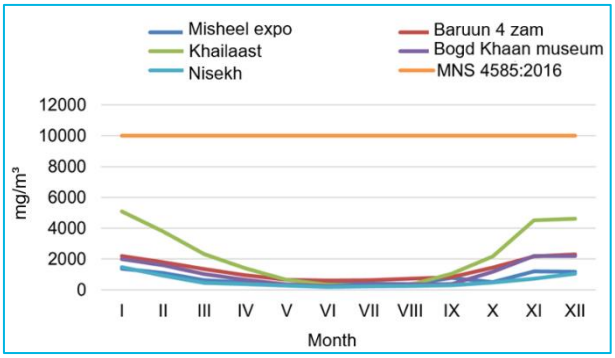


Figure 4-19 Monthly Average Concentration of Carbon Monoxide, 2020-2024

As shown in Figure 4-20, the concentration of particulate matter (PM_{10}-particles smaller than 10 micrometers) exhibits significant seasonal fluctuations. In Khailaast area, PM_{10} concentrations during December and January reach up to 241 µg/m³, which is 4.8 times higher than the permissible limit of 100 µg/m³. In other monitoring locations, winter concentrations are 2 to 2.6 times higher than the standard, while in summer months, concentrations are below the permissible limit.

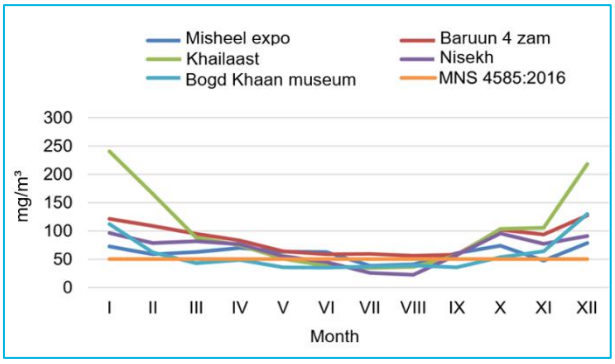


Figure 4-20 Monthly Average Concentration of PM_{10}, 2020-2024

The concentration of particulate matter ($PM_{2.5}$-particles smaller than 2.5 micrometers) in the Khailaast area during the winter months of November, December, and January ranges from 190 to 213 µg/m³, which is 8.5 times higher than the permissible air quality standard. At other monitoring locations, $PM_{2.5}$ levels during the winter months exceed the permissible limit by 1.4 to 3.7 times. However, from mid-April to September, the concentration of fine particulate matter remains within or below the permissible limits (see Figure 4-21).

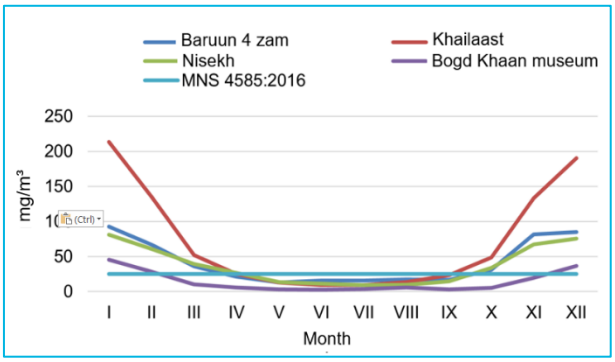


Figure 4-21 Monthly Average Concentration of $PM_{2.5}$, 2020-2024

4.8.1 Air Quality Field Measurement

Ambient Air Quality in the Project Area: A total of 11 sampling locations were selected along the project site to assess ambient air quality. The names of nearby reference landmarks, coordinates, and measured air quality levels within the potentially affected area were compared with the MNS 4585:2016 standard and are presented in Table 4-5. The locations of the sampling points are shown in Figure 4-22. The field survey notes and laboratory results are included in Appendix B.

Table 4-5 Coordinates and Air Quality Level of the Sampling Locations

№	Air Sampling Location	Short name	Latitude	Longitude	SO_2 (μg/m³)	NO_2 (μg/m³)	TSP (μg/m³)
1	Peace Bridge	АЧХЦ01	47°54'22.43"N	106°54'52.47"E	670	20	0
2	120 myangat (Road Intersection)	АЧХЦ02	47°53'58.84"N	106°54'29.32"E	30	32	0
3	Tavan Bogd (Bus stop)	АЧХЦ03	47°53'51.34"N	106°53'18.98"E	0	25	0
4	Yarmag Bridge (in front of OG Family LLC)	АЧХЦ04	47°53'25.26"N	106°52'0.73"E	130	14	0
5	Hunnu mall	АЧХЦ05	47°52'40.00"N	106°51'4.20"E	0	30	0
6	Carrefour supermarket	АЧХЦ06	47°52'17.33"N	106°49'52.13"E	0	24	0
7	Orgil supermarket	АЧХЦ07	47°51'51.98"N	106°48'27.36"E	0	1	0
8	Nisekh Roundabout	АЧХЦ08	47°51'34.26"N	106°47'29.91"E	2	25	0
9	Buyant-Ukhaa sport palace	АЧХЦ09	47°51'5.71"N	106°47'19.36"E	0	65	1
10	Steppe Arena	АЧХЦ10	47°50'50.05"N	106°47'23.73"E	0	2	0
11	West of Khaan Shorgoolj LLC	АЧХЦ11	47°50'1.74"N	106°47'14.50"E	0	3	0
MNS 4585:2016					**450**	**200**	**500**

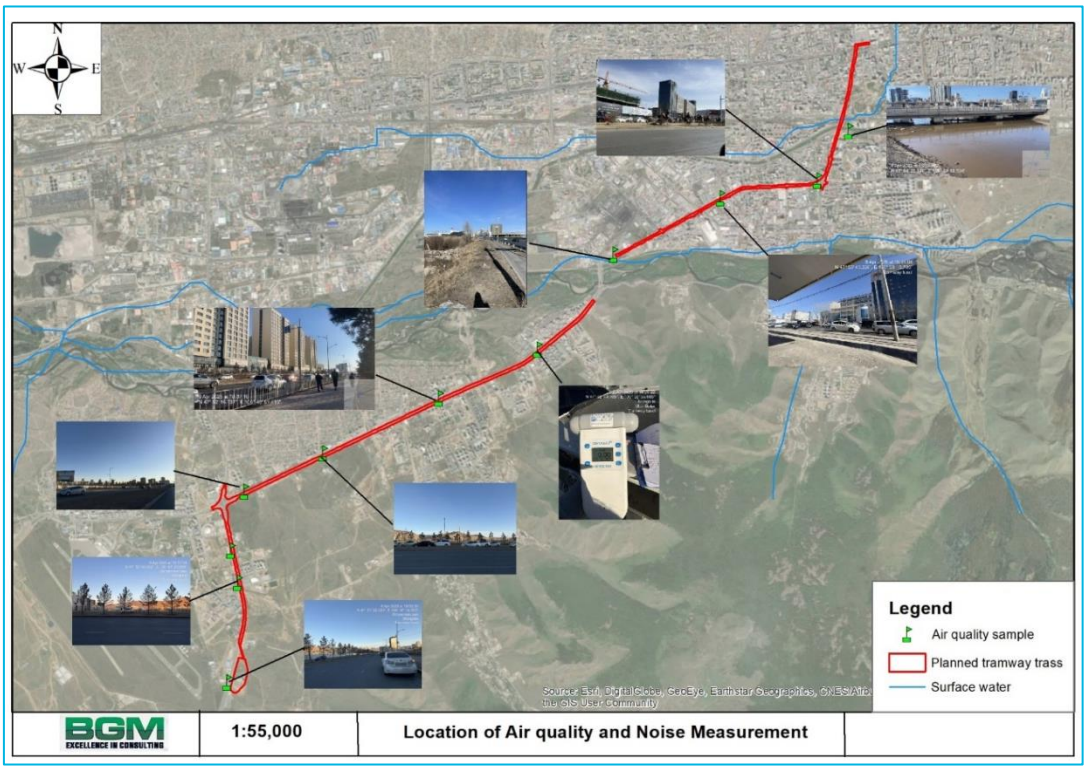


Figure 4-22 Air Quality Sampling Locations

Public health risks increase as the air quality index rises. Different countries have their own air quality indices, corresponding to different national air quality standards. The air quality index was calculated in order to assess baseline air quality of affected area within the project site. The classification of air quality index and relevant uses and treatment issues are described in *Table 4-6*. The air quality index was calculated as below equation.

$$AQI = (C_i / PL_i)*100$$

Where; AQI-air quality index, C_i- concentration of *i* variable, PL_i- permissible values of *i* variable

Table 4-6 Classifiation of Air Quality Index and Definition

AQI	Air pollution category	Definition
0-50	Good	No health implications. Air quality is considered satisfactory and poses little or no risk
51-100	Moderate	Air quality is acceptable. However, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive for air pollutants (ozone substances and particulate matters)
101-250	Unhealth for sensitive groups	Members of sensitive groups may experience health effects i. e people with heart and lung diseases, respiratory problems and bronchitis.
251-400	Unhealthy	General population may experience minor symptoms. Members of sensitive groups may experience more serious health effects.
401-500	Very unhealthy	Health warnings of emergency conditions. The entire population is likely to be affected.
501<	Hazard	Health alert. Everyone may experience more serious health effects.

As shown in Table 4-7, The air quality index in the project site is ranged from 0.1 to 60 as shown in Table 2 4. It is classified as "Good" and "Moderate" according to the air pollution classification. The calculation was based on the highest recorded concentrations of air pollutants, including SO_2, NO_2, and TSP.

Table 4-7 Air Quality Index at the project site

Air sampling location	Air Quality Index	Air pollution category	Impacts on Health
АЧХЦ01	60.0	Moderate	Air quality is acceptable. However, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive for air pollutants.
АЧХЦ02	5.4	Good	No health implications.
АЧХЦ03	2.2	Good	No health implications.
АЧХЦ04	12.5	Good	No health implications.
АЧХЦ05	2.6	Good	No health implications.
АЧХЦ06	2.1	Good	No health implications.
АЧХЦ07	0.1	Good	No health implications.
АЧХЦ08	2.3	Good	No health implications.
АЧХЦ09	5.7	Good	No health implications.
АЧХЦ10	0.2	Good	No health implications.
АЧХЦ11	0.3	Good	No health implications.

Within the scope of the Environmental Baseline Assessment for the project, ambient air quality measurements were conducted at 11 locations, and the results of the analysis are presented in Figure 4-23-Figure 4-25.

According to the analysis results, the concentration of sulfur dioxide (SO_2) in the air ranged from 0.0 to 0.67 mg/m³, nitrogen dioxide (NO_2) ranged from 0.001 to 0.065 mg/m³, and total suspended particles (TSP) ranged from 0.0 to 0.001 mg/m³. These values are within the one-time maximum permissible limits specified in the air quality standard MNS 4585:2016.

During the project implementation, nitrogen oxides (NO_2) emitted from construction machinery and vehicles used for road construction will contribute to an increase in the concentration of nitrogen dioxide (NO_2) in the ambient air. Although sulfur dioxide (SO_2) emissions are expected to be relatively low, certain amounts may still be generated from the combustion of low-quality diesel fuel.

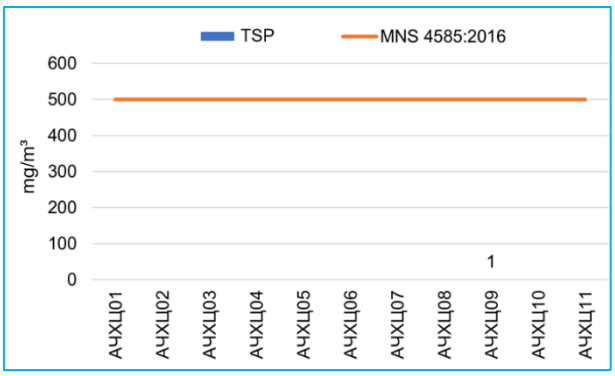


Figure 4-23 20-minute average TSP concentration at the project site (by sampling locations)

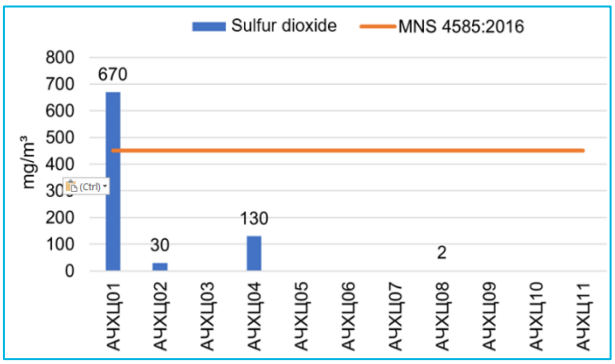


Figure 4-24 20-minute average sulfur dioxide (SO_2) concentration at the project site (by sampling locations)

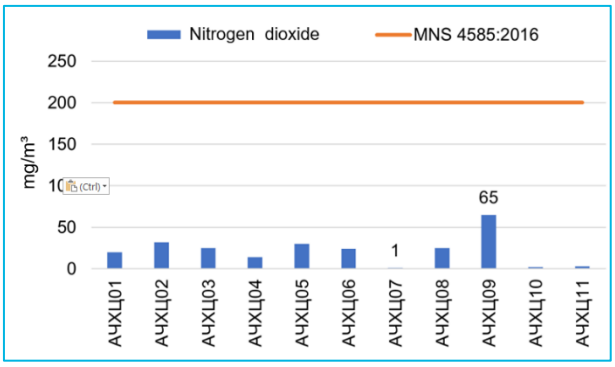


Figure 4-25 20-minute average nitrogen dioxide (NO_2) concentration at the project site (by sampling locations)

4.8.1 Noise measurement

Noise is considered a harmful physical factor to human health and is classified as a form of air pollution. The adverse effects of noise depend on its intensity, spectral composition, and duration

of exposure. Noise in the frequency range of 500 to 3000 Hz has particularly negative effects. Prolonged exposure to noisy environments initially causes rapid fatigue and temporary hearing sensitivity to high frequencies. However, over time, individuals may become accustomed to the noise, with reduced sensitivity to high frequencies, eventually leading to hearing loss and deafness.

When exposed to noise levels of 135–140 dB, vibrations may occur in the soft tissues of the mouth and nose, as well as in the skull and teeth. If the noise exceeds 140 dB, vibrations may also affect the chest cavity and limb muscles, causing headaches, ear pain, extreme fatigue, and irritability. Noise not only affects the auditory system but can also have serious impacts on the central and peripheral nervous systems, cardiovascular function, and may contribute to the development of various health disorders.

The noise level in the project area is largely influenced by the baseline urban noise levels. Therefore, relying on single-instance measurements can be inadequate. Another influencing factor is wind, and noise measurement results can significantly depend on the skill and accuracy of the personnel conducting the assessment

The noise measurement locations are shown in the measurement results are presented in Table 4-8.

Table 4-8 Information of noise measurements

№	Measurements	Short name	Longitude	Latitude	Noise (dBA)
1	Enkhtaivan bridge	АЧХЦ01	47°54'22.43"N	106°54'52.47"E	71.3
2	120 myngat (intersection)	АЧХЦ02	47°53'58.84"N	106°54'29.32"E	74.6
3	Tavan bogd (bus station)	АЧХЦ03	47°53'51.34"N	106°53'18.98"E	73.7
4	Yarmag bridge (in front of OG family LLC)	АЧХЦ04	47°53'25.26"N	106°52'0.73"E	76.6
5	Hunnu mall	АЧХЦ05	47°52'40.00"N	106°51'4.20"E	64.2
6	Carrefour supermarket	АЧХЦ06	47°52'17.33"N	106°49'52.13"E	72.4
7	Orgil supermarket	АЧХЦ07	47°51'51.98"N	106°48'27.36"E	73.6
8	Nisekh roundabout	АЧХЦ08	47°51'34.26"N	106°47'29.91"E	71.5
9	Buyant-Ukhaa sport complex	АЧХЦ09	47°51'5.71"N	106°47'19.36"E	72.6
10	Steppe arena	АЧХЦ10	47°50'50.05"N	106°47'23.73"E	71
11	Khaan shorgoolj LLC	АЧХЦ11	47°50'1.74"N	106°47'14.50"E	64
MNS 4585:2016					**60**

The noise measurement results during heavy traffic and low traffic are shown in Figure 4-26 and Figure 4-27.

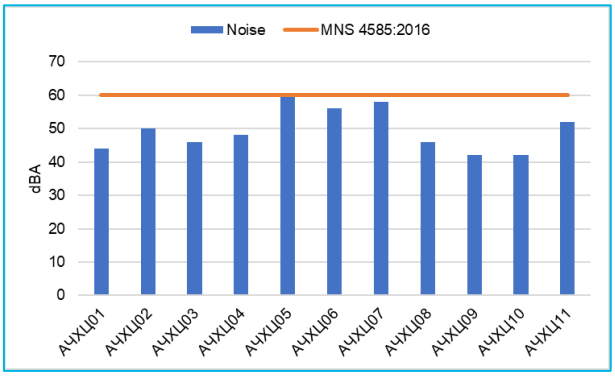


Figure 4-26 Noise level of project site, during heavy traffic

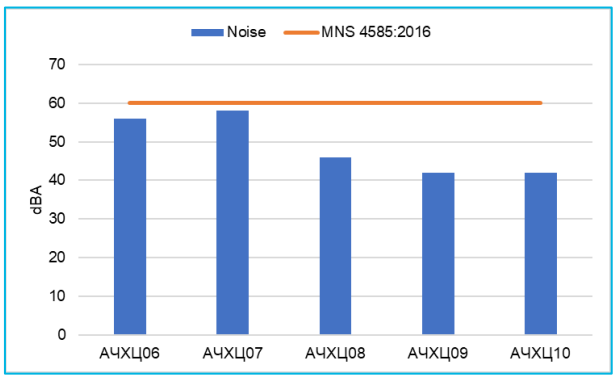


Figure 4-27 Noise level of project site, during low traffic

4.9 Seismic

Over the past 20 years, the Ulaanbaatar city area and its surrounding regions have experienced high seismic activity, with a total of 13,061 recorded[82] earthquakes ranging in magnitude from 0.1 to 5.1.

According to recent studies on seismic activities and seismic risk assessments, the project area belongs to the category of active seismic activity zone with a moderate probability of earthquakes of magnitude 9 on the Richter scale [83] as shown in Figure 4-28.

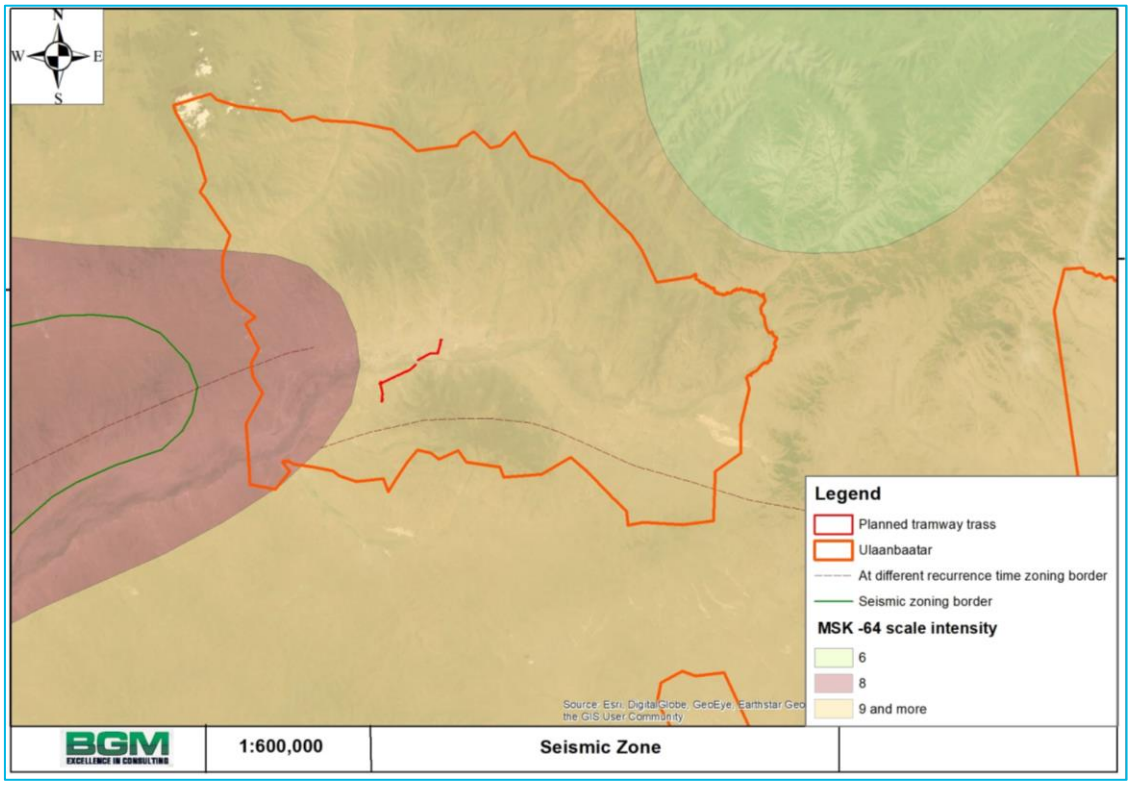


Figure 4-28 Seismic Risk Zoning Map of Project Area

[82] Mongolian Association of Fire Protection Engineers and Technicians, 2020. Disaster Risk Assessment of New Ulaanbaatar International Airport LLC.
[83] https://eic.mn/geodata/download.php?count=10&page=2

4.10 Water Quality

4.10.1 Surface Water Resource

Mongolia has 29 river basins and “The Ulaanbaatar Public Transport (Light Rail Transit-LRT) from General Archives to Sukhbaatar Square” project area is located in the Tuul River basin as shown in Figure 4-29. The Tuul River is approximately 717 kilometers long, with a catchment of approximately 49,840 square kilometers (IWRM, 2012). The Tuul River drains into the Orkhon River. In turn, the Orkhon River is one of the main tributaries of the Selenge River, which is the main artery of Baikal Lake in Russia[84].

As shown in Figure 4-29, the Tuul River Basin consists of 5 sub-basins, and Table4-9 shows watershed areas of each sub-basins with corresponding areas of the Tuul River basin.

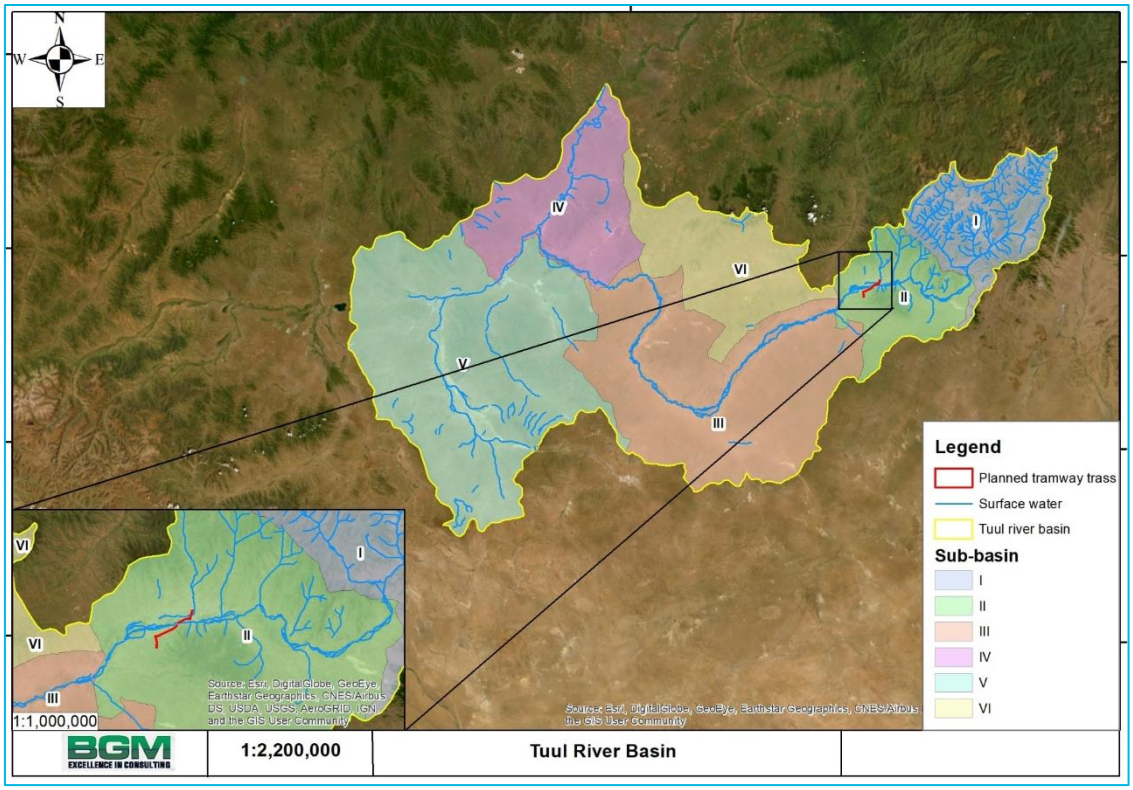


Figure 4-29 Sub-basins in Tuul River Basin

Table4-9 Watershed Area of the Sub-Basin of the Tuul River

№	Sub-Basin	Area (km^2)
1	Sub-basin 1	4426.3
2	Sub-basin 2	3921.5
3	Sub-basin 3	13436.3
4	Sub-basin 4	6069.7
5	Sub-basin 5	16496
6	Sub-basin 6	5682.7

Ulaanbaatar city is located within the 2nd sub-basin of the Tuul River Basin, encompassing densely populated areas of the capital, including summer resorts and ger districts.

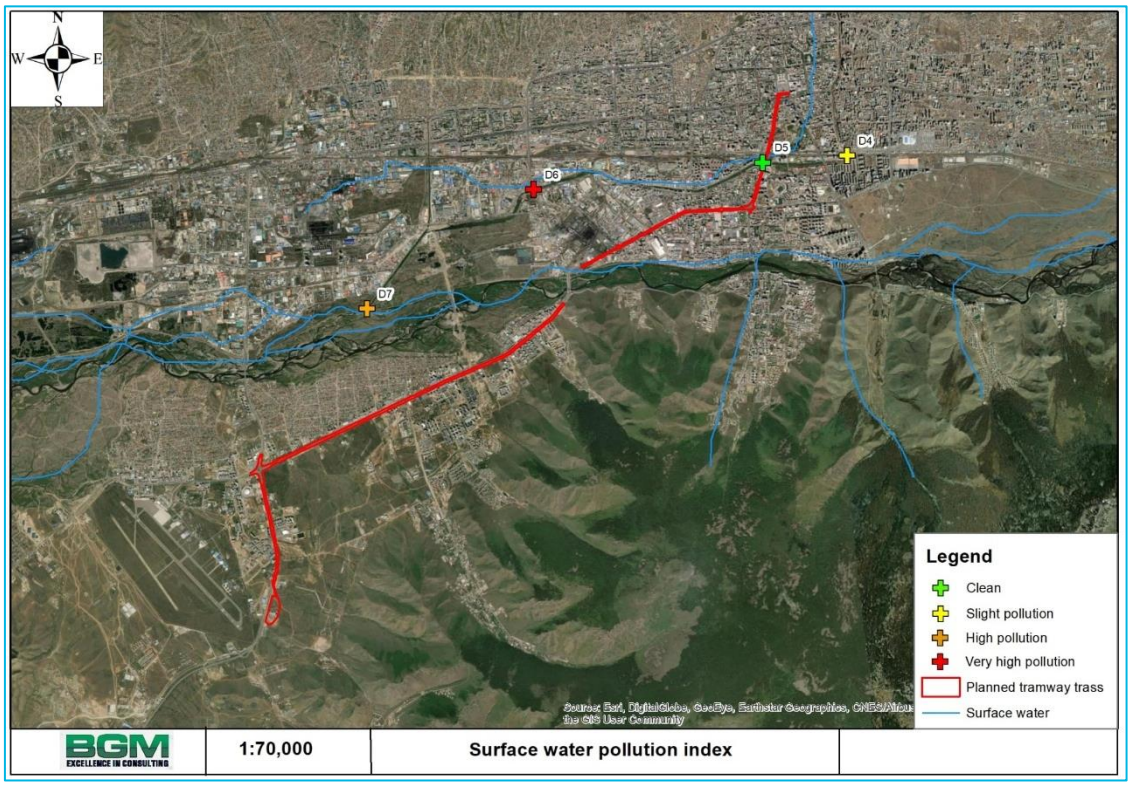
[84] Administration of Tuul river basin, 2019. Tuul river basin environmental baseline assessment. Page 4

4.10.1.1 Surface Water Quality

Previous Studies: The project area extends through the territories of Sukhbaatar and Khan-Uul districts of Ulaanbaatar city. In other words, it lies within the urban settlement zone, specifically along the Selbe, Dund, and Tuul rivers. Therefore, the project area largely overlaps with the area previously studied under the Selbe Revival Project. Accordingly, the current environmental baseline assessment also incorporates and compares the findings from previous studies[85]. In May 2023, a surface water quality survey of the Selbe River was conducted. As part of the study, water samples were collected from three locations in the river, and the chemical composition and heavy metal content of the water were analyzed. The test results were analyzed in accredited laboratories and evaluated by comparing them against the maximum permissible values specified in the national water quality standard "Environmental Quality of Water – General Requirements" MNS 4586:1998.

The chemical analysis results are presented in Table 2-9, and the sampling locations are shown in Figure 4-30. During the study, the hardness of Selbe River water samples ranged from 1.7 mg-eq/L to 4.6 mg-eq/L, classifying it as soft to moderately soft. The water belonged to the hydrocarbonate type and calcium group. While turbidity levels in the river water samples did not exceed permissible limits, a slight increase in turbidity was observed near the confluence of the Dund and Tuul rivers.

Among the chemical indicators, the concentration of ammonium nitrogen (NH_4-N) in samples D-4 and D-7 exceeded the permissible limits defined in MNS 4586:1998 by 1.6 and 1.8 times, respectively. The nitrite nitrogen (NO_2-N) content in samples D-6 and D-7 was found to be 10 to 20 times higher than the allowed limit. A summary of the chemical analysis results of the surface water samples is provided in Table4-10.



[85] BGM Distribution LLC, 2023. Detailed Environmental Impact Assessment for the Selbe Sergelt Project.

Figure 4-30 Sampling locations

Table4-10 Surface Water Quality (chemical)

Parameter (mg/L)	MNS 4586:1998	Sampling point			
		D-4	D-5	D-6	D-7
pH	6.5-8.5	7.5	7.37	7.35	7.3
EC (µS/cm)	-	327	359	302	535
Oxidation value mg/dm^3	-	4.48	1.44	2.56	3.2
Total hardness (mg-eq/l)	7.0	3.0	3.35	3.05	4.6
Na^++K^+	200.0	17.8	16.9	15.6	29.4
Ca^{2+}	100.0	44.9	50.1	43.9	67.1
Mg^{2+}	30.0	9.2	10.3	10.5	15.2
NH_4^+	0.5	**0.8**	0.3	0.1	**0.9**
Fe_{total}	0.3	0.0	0.0	0.0	0.0
Cl^-	300.0	22.4	28.0	20.6	45.1
SO_4^{2-}	100.0	28.0	38.0	29.0	63.0
NO_2^-	0.02	0.02	0.01	**0.5**	**0.3**
NO_3^-	9.0	6.5	0.6	2.6	15.0
CO_3	-	0.0	0.0	0.0	0.0
HCO_3^-	-	152.5	153.1	152.5	189.1
TDS (ppm)	-	196	215	181.0	321.0
Turbidity (NTU)	5.0	2.39	3.56	3.57	4.43

The water quality index of surface water was calculated in order to assess Bukhug River surface water quality in Project area. The water quality index was initially proposed by Horton (Horton, 1965) and it has been applied and modified. Ministry of Nature and Environment of Mongolia (now MET) has developed a water quality index to simplify the complex set of water quality data, and it was used in this report (Ministry of Nature and Environment of Mongolia, 2006).

The classification of the water quality index and relevant uses and treatment issues are described in Table 4-11. The water pollution index was calculated as the below equation.

$$WQI = (\sum (C_i / PL_i)/n)$$

Where; WQI- water quality index, Ci- concentration of i variable, PLi- permissible values of i variable, n- number of variables.

Table 4-11 Classification of Surface Water Quality, Uses and Treatment

WQI	Category	Classification	Uses and treatment
≤0.30	I	Very clean	Suitable for all kinds of water usage. No treatment needed
0.31- 0.89	II	Clean	After treatment, use for drinking and food production. Without treatment, use for the fishery.

WQI	Category	Classification	Uses and treatment
0.90 – 2.49	III	Slight pollution	Unsuitable for drinking and food production. If no choice, use it after treatment. Without treatment, use for livestock, recreation, and sports purposes.
2.50 – 3.99	IV	Moderate pollution	Use for irrigation and industrial purposes after proper treatment.
4.00 – 5.99	V	High pollution	After appropriate treatment, heavy industrial use without body contact.
6.00≤	VI	Very high pollution	Unsuitable for any purpose. An extensive treatment requires
Source: Ministry of Nature and Environment of Mongolia, 2006			

Based on previous surface water sampling data[86], the water pollution index was calculated using the concentrations of ammonium (NH_4), nitrate (NO_3), nitrite (NO_2), and sulfate (SO_4). The permissible values were derived from MNS 4586:1998[87].

As can be seen in Table 4-12, for D-5 is in category II, Clean; the D-4 is in category III, Slight pollution; D-7 (downstream section of the Selbe River) in category V, High pollution; D-6 (Bridge fall under) category VI, Very high pollution (see Table 4-12).

Table 4-12 Surface Water Pollution Index

WQI	Category	Classification	Uses and treatment	Surface water sampling location
≤0.30	I	Very clean		
0.31- 0.89	II	Clean	D-5	0.39
0.90 – 2.49	III	Slight pollution	D-4	0.90
2.50 – 3.99	IV	Moderate pollution		
4.00 – 5.99	V	High pollution	D-7	4.77
6.00≤	VI	Very high pollution	D-6	6.44

Results of surface water field survey : On April 8, 2025, the BGM team collected Selbe and Tuul River surface water samples at 2 locations for chemical analysis (see Figure 4-31). The samples were sent to the Water Analysis Laboratory of the Institute of Geography and Geoecology, Mongolian Academy of Sciences, for chemical analysis, and the results of the analysis are attached in Appendix A. The permissible values were derived from the MNS 4586:2024 standard. The waters of the Tuul and Dund rivers have a total hardness ranging from 1.3 mg-eq/L to 2.4 mg-eq/L and are classified as soft to very soft, belonging to the hydrocarbonate class and the calcium group. Sample-3 falls under the following classifications compared to the MNS 4586:2024 standard: Class IV in terms of ammonium nitrogen (NH_4-N) and nitrite nitrogen (NO_2N); Class V in terms of nitrate nitrogen (NO_3-N); Class I in terms of turbidity; Class III in terms of oxidizability. Sample-4 falls under: Class III in terms of ammonium nitrogen (NH_4-N); Class V in terms of nitrate nitrogen (NO_3-N); Class I in terms of turbidity and oxidizability. The surface water sampling results are shown in Table 1-12.

[86] BGM Distribution LLC, 2023. Detailed Environmental Impact Assessment for the Selbe Sergelt Project.
[87] Water quality. General requirements:
Scope: 1.1 This standard applies to the determination of the quality of the aquatic environment in order to create conditions for living in a healthy environment and to ensure ecosystem balance. 1.2 This standard does not apply to aquatic environments, specific mineral water requirements, natural mineralization, and high concentration and in accordance with established procedures.

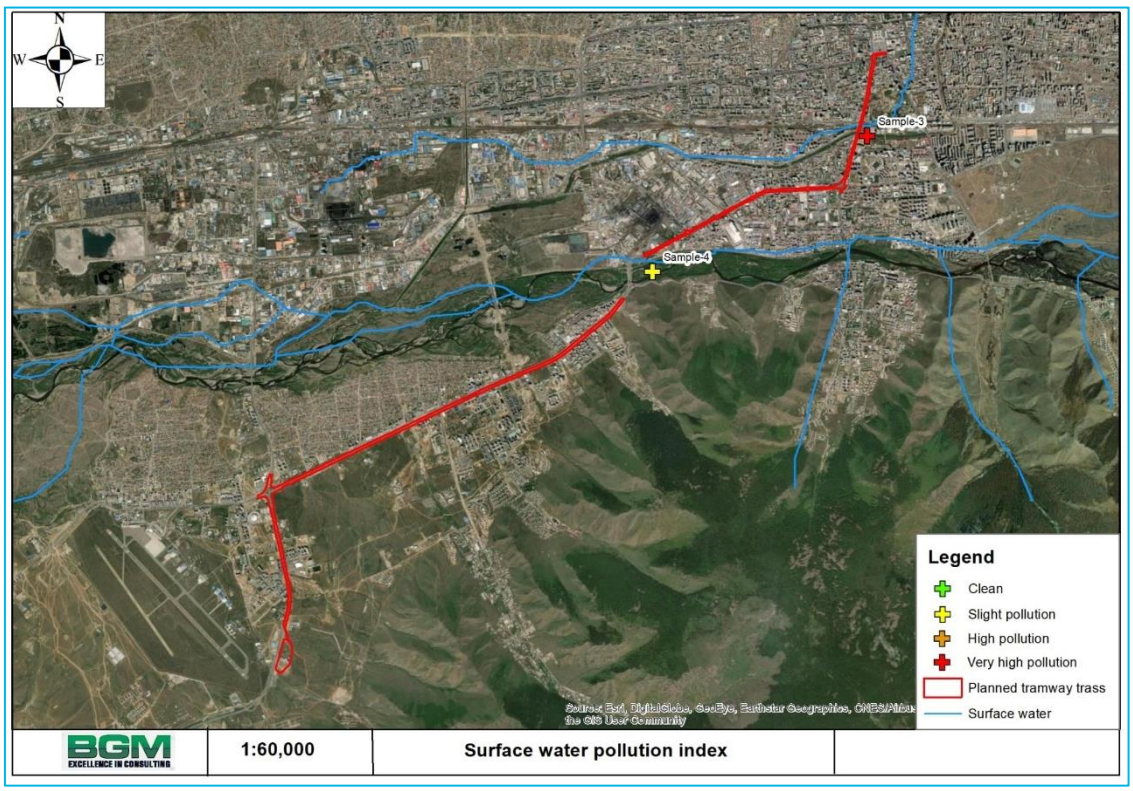


Figure 4-31 Surface water sampling locations

Table4-13 Results of Surface Water Quality

Parameter	Units	MNS 4586:2024					Sampling points	
		Class I	Class II	Class III	Class IV	Class V	Sample -3	Sample -4
pH	-	**6.5-8.5**	6.5-8.5	6.5-9	6.5-9	6.5-9	7.69	7.76
Total hardness	мг-экв/л	**<7**	10	10	10	>10	2.42	1.27
Ca^{2+}	мг/л	**<25**	100	200	300	>300	38.7	21
Mg^{2+}	мг/л	<10	30	50	100	>100	6	2.7
NH_4^+	мгN/л	<0.2	0.4	0.8	3.1	>3.1	1.5	0.4
Fe_{total}	мг/л	<0.3	1	3	5	>5	0.0	0.0
Cl^-	мг/л	>200	200	350	500	>500	21.7	7.8
SO_4^{2-}	мг/л	<60	100	200	400	>400	21	5
NO_2^-	мгN/л	>0.01	0.06	0.12	0.3	>0.3	0.1	0.0
NO_3^-	мгN/л	>1	3	6	10	>10	8	4
Turbidity	NTU	>5	25	50	100	>100	21.5	11.5

Based on surface water data, the water quality index was calculated using ammonium (NH_4), nitrate (NO_3), nitrite (NO_2), and sulfate (SO_4) concentrations (as nutrient concentrations, which depend on pollution source). The permissible values were derived from MNS 4586:2024.

As can be seen in Table4-14, sample-4 is in category III, Slight pollution; sample-3 is in category VI, Very high pollution.

Table4-14 Surface Water Pollution Index

WQI	Category	Classification	Surface water sampling location	Calculated WPI
≤0.30	I	Very clean		
0.31- 0.89	II	Clean		
0.90 – 2.49	III	Slight pollution	Deej-4	1.5
2.50 – 3.99	IV	Moderate pollution		

WQI	Category	Classification	Surface water sampling location	Calculated WPI
4.00 – 5.99	V	High pollution		
6.00≤	VI	Very high pollution	Deej-3	6.5

4.10.1.2 Heavy Metals

Previous Studies: As part of the results of the previous study[88] conducted in 2023, heavy metal analysis was performed on three surface water samples collected from the Selbe, Dund, and Tuul rivers. According to the test results, the heavy metals Mn, Cu, Pb, Cr, Zn, and Hg were not detected in the samples, and no concentrations exceeded the permissible limits specified in the standard. A summary of the heavy metal analysis results is presented in Table 4-15.

Table 4-15 Results of surface water heavy metal analysis

Heavy metal ,mg/l	MNS 4586:1998	Sampling location			
		D-4	D-5	D-6	D-7
Mn	0.1	<0.005	<0.005	<0.005	<0.005
Ni	0.01	0.0005	0.0004	0.0003	0.0016
Cu	0.01	<0.005	<0.005	<0.005	<0.005
Mo	0.25	0.0016	0.0014	0.0017	0.0019
Cd	0.005	<0.00001	0.00001	0.00001	0.00002
Co	0.01	0.00016	0.00015	0.00015	0.00027
Pb	0.01	<0.0005	<0.0005	<0.0005	<0.0005
As	0.01	0.00107	0.00103	0.00113	0.00237
Cr	0.1	<0.01	<0.01	<0.01	<0.01

Results of surface water field survey: Heavy metal analysis of surface water samples collected from "The Ulaanbaatar Public Transport (Light Rail Transit–LRT) from General Archives to Sukhbaatar Square" project and the samples were sent to SGS IMME Mongolia laboratory for heavy metals. A total of 9 commonly occurring heavy metals (Mn, Ni, Cu, Mo, Cd, Co, Pb, As, Cr) were tested. According to the analysis results of the water samples from the Dund River and the Tuul River, no heavy metals were detected, and no values exceeded the permissible limits set in the Water Quality Standard MNS 4586:2024. A summary of the heavy metal analysis results is shown in Table4-16.

Table4-16 Results of surface water heavy metal analysis

Heavy metal mg/l	MNS 4586:2024					Sampling location	
	Class 1	Class 2	Class 3	Class 4	Class 5	Sample-3	Sample -4
Mn	<0.1	0.1	0.5	1	>1	0.005	0.005
Ni	<0.008	0.02	0.04	0.08	>0.08	0.0003	0.0003
Cu	<0.02	0.1	1	1	>1.0	0.005	0.005
Mo	<0.08	0.1	0.2	0.25	>0.25	0.0011	0.0003
Cd	<0.001	0.001	0.005	0.005	>0.01	0.00001	0.00001
Co	<0.01	0.01	0.01	0.01	>0.01	0.00006	0.00006
Pb	<0.01	0.01	0.05	0.05	>0.1	0.0005	0.0005
As	<0.005	0.01	0.01	0.1	>0.1	0.00165	0.00097

[88] BGM Distribution LLC, 2023. Detailed Environmental Impact Assessment for the Selbe Sergelt Project.

Heavy metal mg/l	MNS 4586:2024					Sampling location	
	Class 1	Class 2	Class 3	Class 4	Class 5	Sample-3	Sample -4
Cr	<0.06	0.06	0.11	0.16	>0.16	0.01	0.01

4.10.1.3 Bacteria (Microorganism)

A study on bacterial contamination of the Selbe River was conducted in 2014 in summer camp areas such as Sharga Morit, Khandgait, Bayanbulag, and Goodoi. In this study, the total number of bacteria per 1 ml of water, Escherichia coli (E. coli), and Clostridium perfringens spores were determined and compared against the standards MNS 0900:2005 and MNS 4643:2000. No C. perfringens spores were detected at the sampling sites; however, the total bacterial count per 1 ml of water exceeded the permissible limit by 150 to 350 times, and E. coli levels exceeded it by 23 to 60 times. Compared to the 2010 study on the Selbe River by the Institute of Geography, Mongolian Academy of Sciences, these microbiological indicators have increased several times. The main causes of bacterial contamination in the Selbe River are the increasing number of summer houses and service facilities, as well as pit latrines and waste accumulation in the area (Bolormaa, 2014).

4.10.2 Flood Risk Assessment

The long-term average annual precipitation in the Ulaanbaatar area ranges from 252.2 to 275 mm, with most of the rainfall occurring during the summer season under the influence of cyclones. Since most of the precipitation is in the form of intense showers, the maximum daily precipitation is observed during heavy rain events. A daily maximum precipitation of 37.2 mm was recorded on July 23, 1963, and 74.9 mm in 1967. On August 3, 1982, 44.2 mm of precipitation fell within 20 minutes, causing a flash flood, which was the most intense rainstorm observed. On August 10, 1994, 19.5 mm of precipitation was recorded between 08:00 and 20:00, with a daily total of 23.3 mm. Based on long-term observation data from the Ulaanbaatar station, statistical analysis using the moment method was conducted and a exceedance probability curve was constructed. The estimated maximum daily precipitation with a 1% exceedance probability is 125.4 mm, which was used in the design calculations for peak runoff in the stream that drains into the Selbe River[89] [90].

Table 4-17 Daily rainfall with 1% exceedance probability, mm

Station	Observation Period	Observation Period			Peak discharges with various exceedance probabilities, m^3/s					
		High	Low	Average	0.1%	1%	3%	5%	10%	25%
Ulaanbaatar	**1940-2020**	**74.9**	**5.9**	**30**	**196.2**	**125.4**	**93.6**	**80.1**	**62.3**	**39.8**

4.10.2.1 Hydrological Study of the Selbe River

- **Morphology of the Selbe River:** Originating between the Ikh Bayan Mountain (2033.3 m) and Tsohiot Mountain (1706 m), which are low-altitude ridges on the southwestern flank of the Khentii Mountain Range, the Bayangiin River flows westward and merges from the east with the Khandgait River, after which it is called the Selbe River. It flows through a forested valley between low mountains and joins the Tuul River near the vicinity of Ulaanbaatar City (near 4th Thermal Power Plant). More than 10 tributaries flow into the Selbe River from the east and west, significantly contributing to the peak flood discharges. Major tributaries include, from the east: Ikh Bayan, Baga Bayan, Ereen Gunan, Khandgait,

[89] Prestige Engineering LLC. (2024). Feasibility Study of the Selbe–Dund River Flood Protection Structures
[90] BGM Distribution LLC. (2024). Detailed Environmental Impact Assessment Report for the Selbe Revival Project. Pages 5–146

Bayan Bulag, Sharga Morit, Goodoi, and Belkh; and from the west: Khalzan, Shar Khooloi, Uvur Gunt, and Jigjid. In addition, during summer rain events, Gants Khudgiin Am from the east and Chingeltei and Khailaast streams from the west contribute surface runoff, while at the river mouth, water from the Baruun Uul also flows in. The total length of the Selbe River is 50.67 km, with a catchment area of 323 km², expanding to 430.4 km² after the confluence with the Baruun Uul Canal. The average elevation of the basin is 1621 m, and the channel slope is 14.5%. The river is classified as a third-order stream.The river valley has an average width of 100–150 m, reaching 400–500 m in some areas. Valley side slopes are 4–5 m high, covered with meadow vegetation (see Figure 4-32). The river channel is gradually shifting, featuring riffles, pools, and small islands in some locations. The channel width is generally 20–25 m, with an average water depth of 0.1–0.5 m, and banks with heights of 0.4–0.6 m.

- **Long-term average streamflow:** Continuous hydrological study of the Selbe River was conducted from 1985 to 1991 near the Dambadarjaa, and since 1994 at the Sanzai Resort area through the establishment of hydrological monitoring stations. The streamflow regime characteristics of the Selbe River were determined based on observations from 2 stations operated by the Selbe-Sanzai (1994-2017) and Selbe-Dambadarjaa (1985-2017) hydrological posts of the National Agency Meteorology and the Environmental Monitoring located in Sukhbaatar District, Ulaanbaatar. To determine the long-term average and streamflow rates with various exceedance probabilities at the calculation cross-section, the following values were used: At the Selbe–Sanzai station: long-term streamflow module (Mo) is 0.06 L/s·km², and the long-term average streamflow is 2.00 m³/s; at the Selbe–Dambadarjaa station: long-term streamflow module is 5.84 m³/s, and the long-term average streamflow is 0.39 L/s·km² (see, Figure 4-32 and Table 4-18).

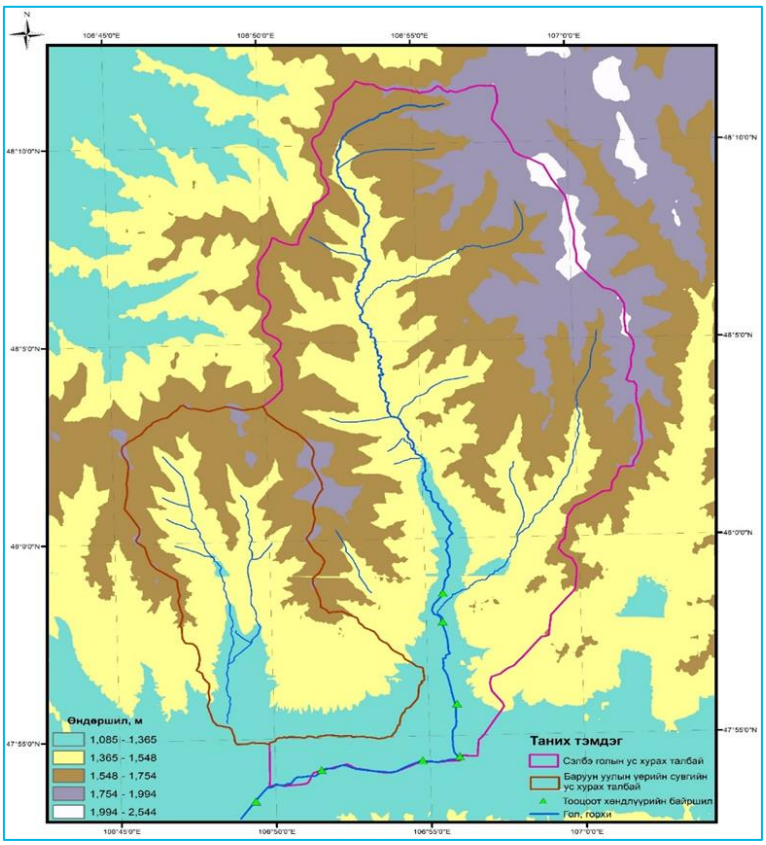


Figure 4-32 Watershed area of the Selbe River

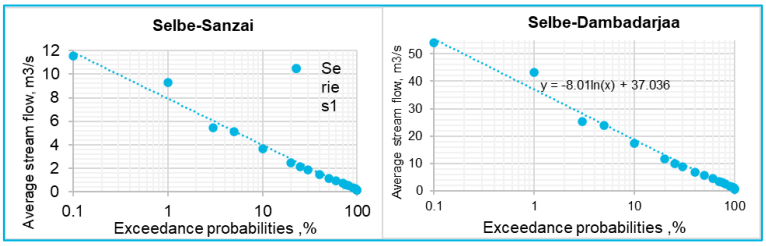


Figure 4-33 Watershed area of Selbe river,

Table 4-18 Selected Indicators of Average Streamflow at Selbe River Hydrological Stations (Based on average streamflow observation data from the hydrological stations)

Cross-section	Observed Average Annual Streamflow				Observed Average Annual Streamflow by Exceedance Probability, (m³/s)			
	Streamflow module L/s*km²	Average streamflow, m³/s	Coefficient of variation					
			Cv	Cs	25%	50%	75%	95%
Selbe-Sanzai	0.06	2.00	0.59	0.05	2.14	1.16	0.62	0.10
Selbe-Dambadarjaa	0.39	5.84	1.15	1.53	6.26	3.41	1.84	0.75

- **Study on Peak Floods of the Selbe River:** The 1% exceedance peak flow of the Selbe River has been calculated by hydrologists of different periods using various methodologies, based on long-term maximum streamflow observation data.
- In 1965, hydrologist M.V. Rosomakhin estimated the 1% exceedance flood discharge of the Selbe River using the formula proposed by T.A. Alekseeva: $Q = \frac{0.004}{n} J^{4/9} (\text{в}hz)^{4/3}$ for a catchment area of 305 km². The coefficient of variation (Cv) was 0.638, and assuming Cv = 4Cs, the calculated discharge for the 1% exceedance flood was Q_1% = 232 m³/s. Following the major flood event in 1966, additional survey and investigation were carried out, and during the project design stage, the 1% exceedance peak flood discharge of the river was determined to be 411 m³/s.
- In 1988, within the framework of the bank improvement design project of the Selbe River by the Institute of Geography and Geoecology, the 1% peak flood discharge was calculated for various cross-sections using the reduction formula: $Q = q_{\text{oy.T}} \frac{\partial_1 \partial_2}{\partial_{1T} \partial_{2T}} (\frac{A_T}{A})^{0.3} A$. As a result, the 1% peak flood discharge corresponding to a 302 km² catchment area was determined to be 409 m³/s.
- In 1993, N. Dashdeleg and colleagues extended the 1984–1991 data series of the Selbe–Dambadarjaa hydrological station (276 km²) using analogous river data. Using statistical and graphical-analytical methods, they estimated the 1% peak flood discharge to be 350 m³/s.
- In 2004, researchers from the Hydrology Division of the National Agency Meteorology and the Environmental Monitoring estimated the peak flood discharge from rain-induced floods in rivers and streams around Ulaanbaatar city. As part of the project on flood hazard mapping, the peak discharge at the Dambadarjaa hydrological station was determined to be 350 m³/s. This value was later cited in 2012 by Y.Tuul in her doctoral dissertation on the hydrological assessment of flood protection for Ulaanbaatar city. In 2012, G.Davaa, D.Oyunsanaa, S.Tumurchudur, and Z.Munkhzaya estimated the peak flood discharge of rain-induced floods with different exceedance probabilities to be 169 m³/s at the Dambadarjaa station, as part of a study compiling data for the Integrated Water Resource Management Plan of the Tuul River Basin.
- In 2015, as part of a study on flood risk assessment and the development of a flood management strategy for Ulaanbaatar city, G. Adiyabadam estimated the peak flood discharge of the Selbe River to be 345.9 m³/s at the Dambadarjaa hydrological station, considering the river mouth near the DHL building as the reference cross-section.

4.10.2.2 Hydrological Study of the Selbe River

According to the results of the 12 years (e.g., between 2008 and 2019) of measured flow data of Tuul River, the multi-year average flow at the Tuul-Bosgo hydrological station is 9.3 m^3/s, the multi-year average flow at the Tuul-Terelj hydrological station is 6.25 m^3/s, the multi-year sundage flow at the Tuul-Ulaanbaatar hydrological station is 16.24 m^3/s, and the multi-year average flow at the Tuul-Altanbulag hydrological station is 10.1 m^3/s.

Floods occurred in the territory of Ulaanbaatar city in 1934, 1959, 1966, 1967, 1982, 1992, 1994, 1996, 1998, 2003, 2005, 2006, 2008, 2009, 2012, 2016, 2018, 2021, and 2023. For example, during the flood in 1966, the Tuul River exceeded the flood danger level by 51 cm and reached 311 cm. However, during the flood in 2023, the flood danger level of the Tuul River was 50 cm, or close to the flood danger level of 260 cm.

The highest flow of the Tuul River is observed during the rainy season. The river floods 3-5 times in a rainy year, and weak and strong yellow water floods are observed in the rivers of this basin. The yellow water flood, which is likely to occur once in a century, will reach 480 m^3/s in the Tuul River and 140 m^3/s in the Terelj River. The highest annual discharge is observed during the rainy season, and the highest discharge of the major flood, which is likely to occur once in a century, will reach 1850 m3/s in the Tuul-Ulaanbaatar and 822 m^3/s in the Terelj River. The flood duration is 14 days, and the period of rise and fall is 10 days[91]. This estimate of the major discharge of the Tuul River should be considered in more detail in the future.

4.10.3 Groundwater Quality

4.10.3.1 Geological and Hydrogeological Setting

The hydrogeological conditions of the study area consist of loose sediments distributed along the branches of the mountain ranges adjacent to the Tuul River and the mountains within the catchment area. Based on the geological structure and baseline hydrogeological conditions, the following aquifers and groundwater accumulations have been distinguished in detail using the results of previous studies:

- Aquifer formation of Modern Quaternary or Holocene age (al/Q_2)
- Upper or modern Quaternary or Pleistocene-Holocene aquifer formatio ($d\text{-}pl/Q_{1\text{-}2}$)
- Aquifer in the Neogene-Pleistocene age sediment (N_1gs)
- Unevenly distributed aquifer in sedimentary-metamorphic rocks of early and middle Carbon age-Altan Ovoo formation ($C_{1\text{-}2}ao_1$)
- Unevenly distributed aquifer in sedimentary-metamorphic rocks of early-middle Carbon age, Orogchin mountain formation ($C_{1\text{-}2}oy$)
- Unevenly distributed aquifer in sedimentary-metamorphic rocks of middle and modern Devon age-Gorkhi formation ($D_{1\text{-}2}gr_1$)

[91] Х.Бадарч, 2014. Туул голын уртын дагуух урсацын хуваарилалт ба алдагдал /Улаанбаатар хот орчим/:http://portal.igg.ac.mn/dataset/cd2477a9-c478-487a-9c64-ae9bbf593670/resource/84cf4533-ac16-44dd-bb55-80338bf61d54/download/-1..pdf

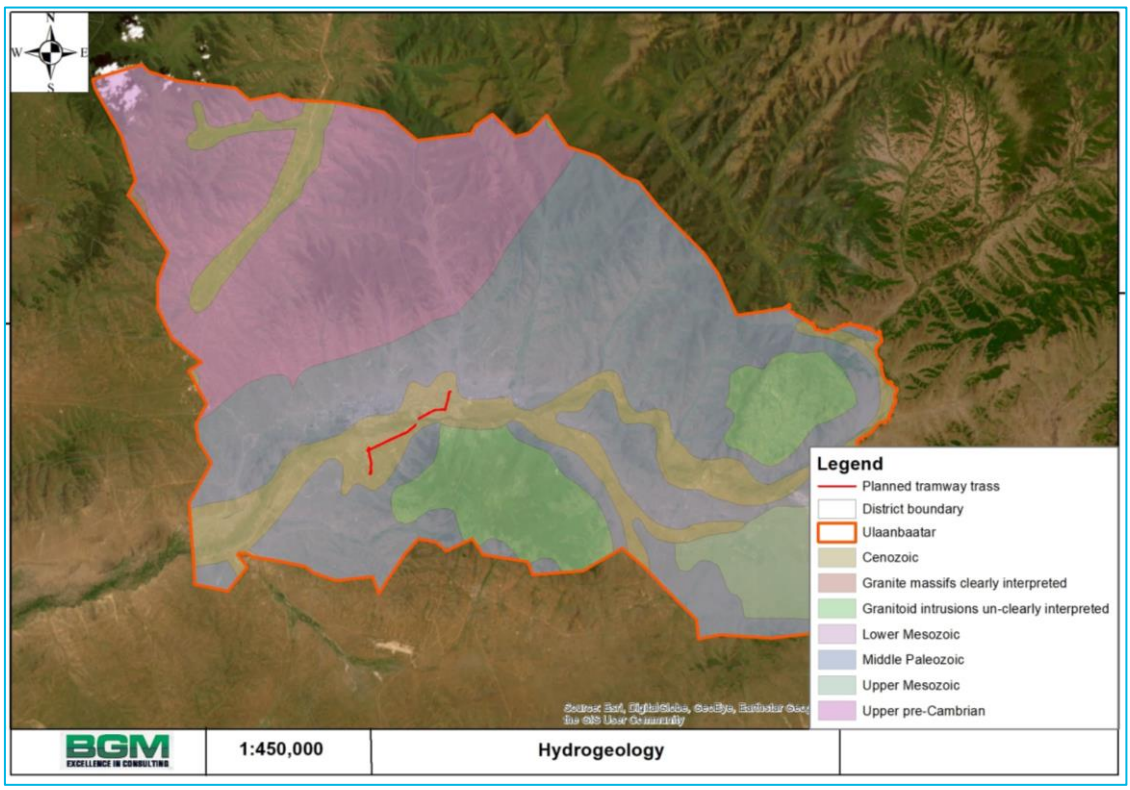


Figure 4-34 Hydrogeological Map in Project area

4.10.3.2 Groundwater Resources

Renewable groundwater resources of the Tuul River basin are formed annually to a total of 960.0 million cubic meters[92]. In other words, renewable groundwater resources at the location where the project would be implemented are classified as 10-20 mm/year*km^2 and 20-30 mm/year*km^2 As shown in Figure 4-35.

In addition to this, potential exploitable groundwater resources of the Tuul River basin is approximately equal to 641 million cubic meters per year[93], whereas potential exploitable groundwater resources at the location where the project would be implemented is classified as confined/unconfined groundwater in karst aquifer with low to moderate recourse (0.3-1 l/s) and high recourse (>10l/s) as shown in Figure 4-36.

[92] https://faolex.fao.org/docs/pdf/mon169814.pdf
[93] https://faolex.fao.org/docs/pdf/mon169814.pdf

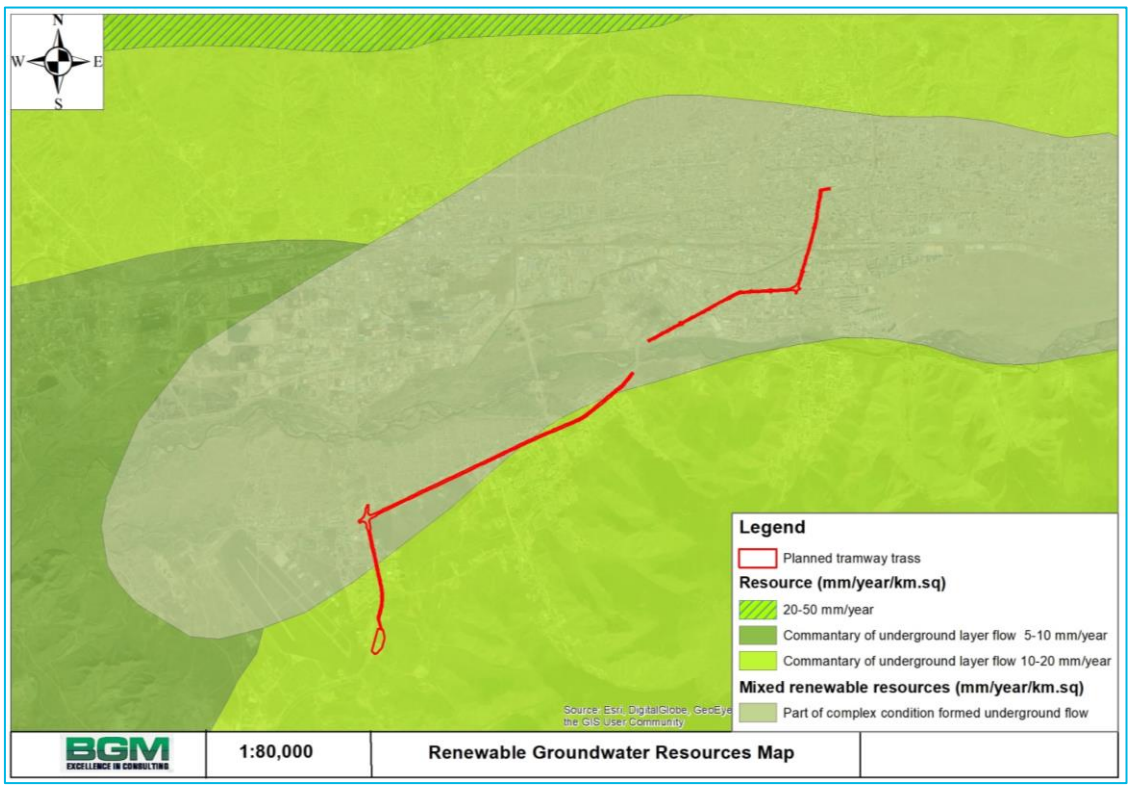


Figure 4-35 Renewable Groundwater Resources Map of the Project Area

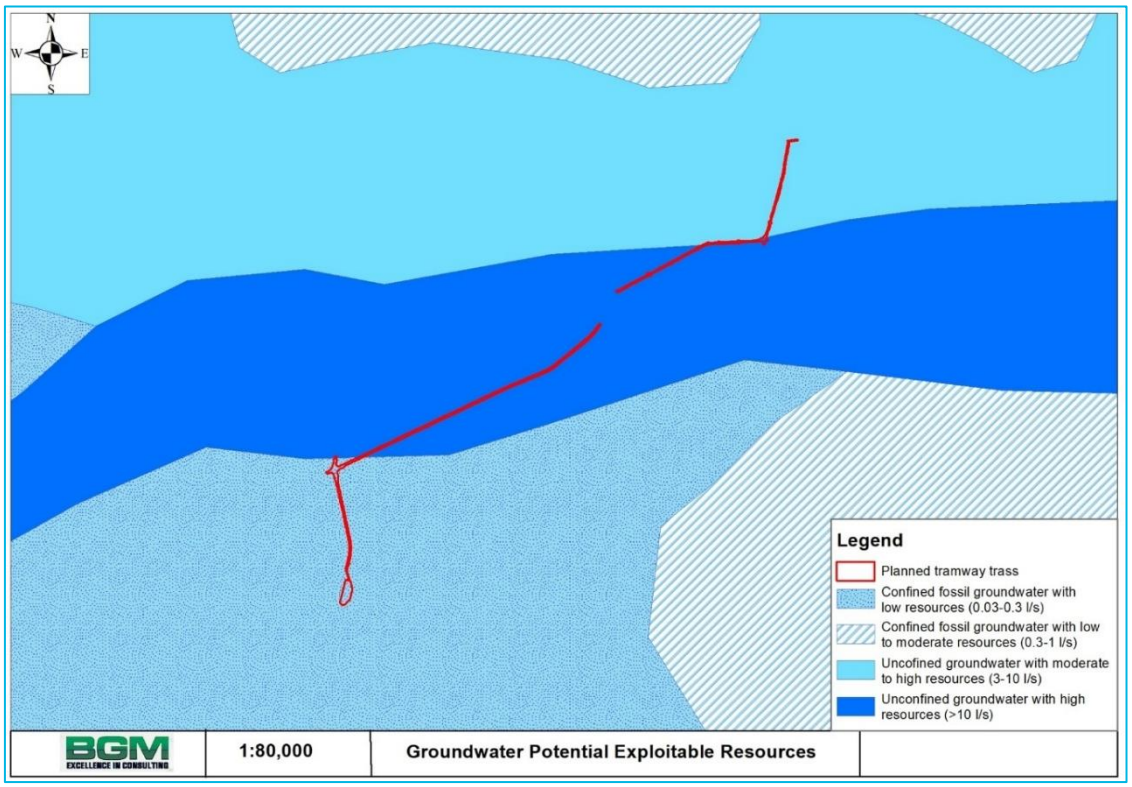


Figure 4-36 Groundwater Potential Exploitable Resources

4.10.3.3 Permafrost

As shown in Figure 4-37, Permafrost distribution in “The Ulaanbaatar Public Transport (Light Rail Transit-LRT) from General Archives to Sukhbaatar Square” where project would be implemented belongs to sporadic permafrost region and sparsely island permafrost region.

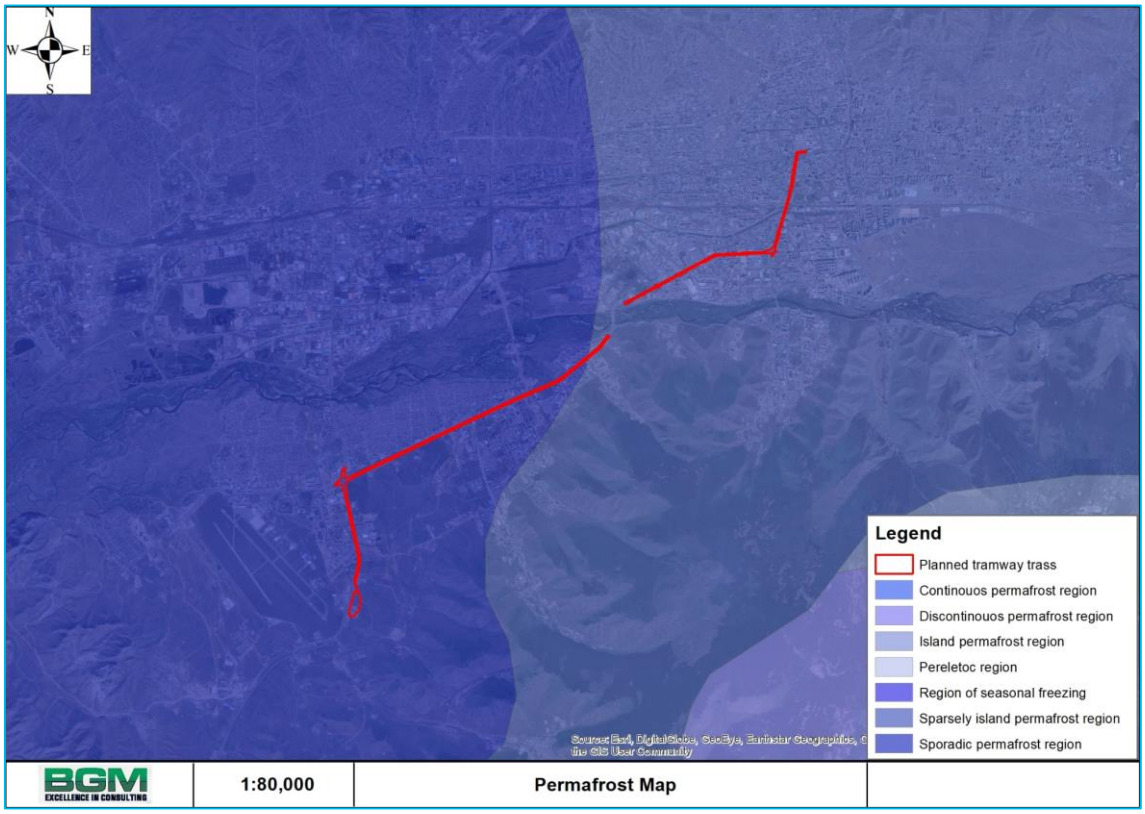


Figure 4-37 Permafrost Distribution in Project area

4.10.3.4 Groundwater quality

The average daily water consumption for drinking and industrial use in Ulaanbaatar city is approximately 150,000 m³, which is supplied entirely from clean groundwater sources (Naranchimeg et al., 2018). As the population concentrated in Ulaanbaatar continues to grow, water consumption is also steadily increasing. According to the legislation of Mongolia, groundwater resources used for centralized and non-centralized water supply systems in major cities and settlements must be subjected to hygiene requirements, quality, and safety monitoring before being distributed to consumers for drinking purposes and only after such sanitary inspections and quality assessments can safe and clean drinking water be provided to the public.

4.11 Soil

The project titled “Ulaanbaatar Tram (LRT) from the General Archives to Sukhbaatar Square” is being implemented in parts of Ulaanbaatar city with high population density and relatively well-developed infrastructure. The project area spans across Sukhbaatar and Khan-Uul districts of Ulaanbaatar, specifically along paved roads in residential zones with dense population. The project area largely overlaps with the area studied during the "Selbe Revival" project. Therefore, the soil characteristics in this baseline environmental assessment report have been identified based on the results of the previous studies. In the area along the proposed project corridor, alluvial soils are found in the Tuul River valley, and meadow swampy soils are found along the Dund and Selbe Rivers. Additionally, anthropogenic soils (anthrosols) have formed in areas where long-term human activity has altered the natural soil structure. In May 2023, field research[94] on the soil cover was conducted following the Selbe Revival project's route. During this survey, a

[94] BGM, 2023. Detailed Environmental and Social Impact Assessment of the “Selbe sergelt” project.

total of six soil profile cuts were made. From these profiles, 18 soil horizon samples were collected, along with three samples for heavy metal analysis and three samples to determine microbial contamination in accordance with relevant standards. The excavation, sampling, transportation, and storage of the soil samples during the study were carried out in compliance with Mongolian standards: “MNS3298-90: Soil. General requirements for taking samples for analysis” and “MNS2305-94: Soil. Sampling, packaging, and transportation procedures,” as well as other applicable regulations. The physical and chemical parameters of the soil samples were analyzed in the laboratory of “Engineering Geodesy” LLC. The concentration of heavy metals in the soil was analyzed by “SGS” LLC, and the level of microbial contamination in the soil was analyzed by “Nart SHYUN Consulting” LLC.

Within this study, soil sampling are taken from 6 locations and samples are sent to “Nart SHYUN Consulting” LLC for further analysis. The locations of the soil sampling points are shown in Figure 4-38.

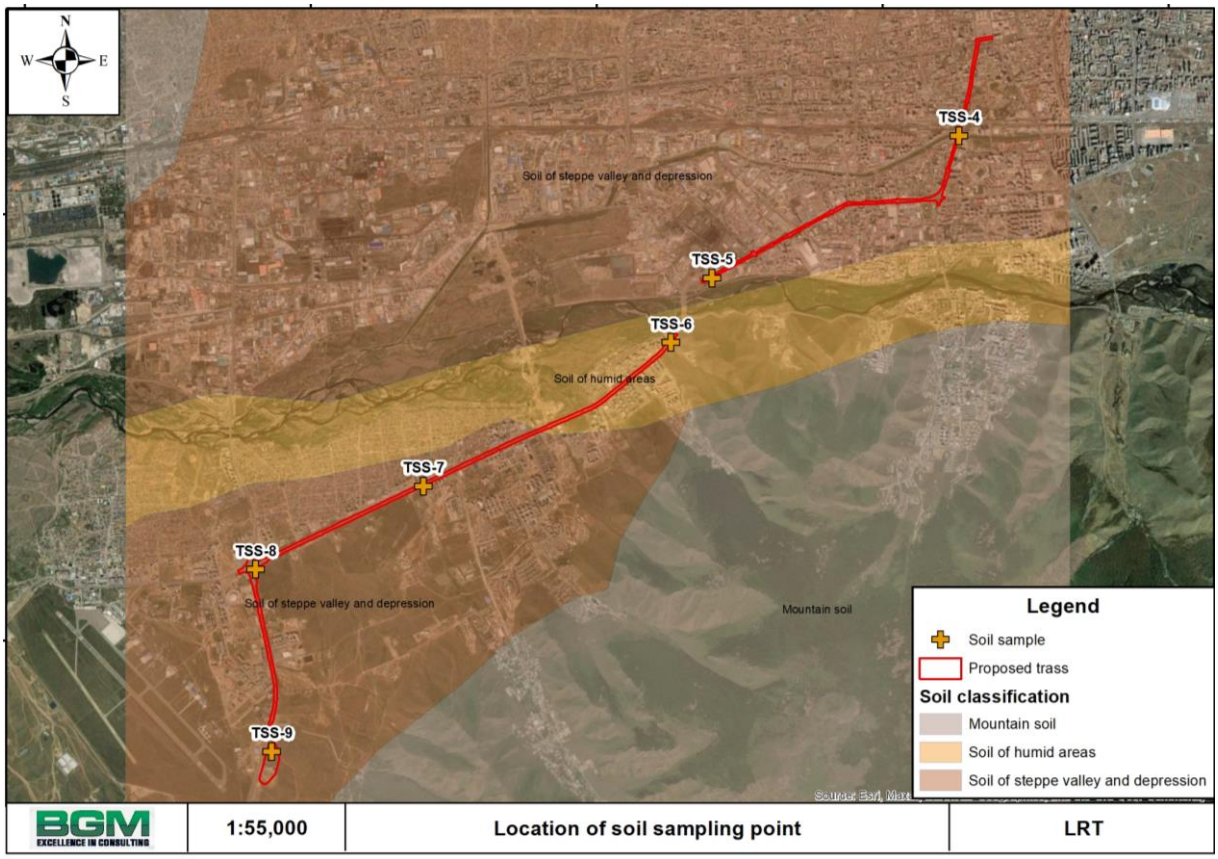


Figure 4-38 Distribution of Soil Types in the Project Area

The study areas were following the soil-geographical region is 39th district of southern Khentii region with altitude zones [95]. Based on the soil cover study, the following three sub-types of soils were identified in the study area:

- Alluvial soil
- Meadow swampy soil
- Anthrosol soil.

[95] National Atlas. 2009.

4.11.1 Soil Chemical Properties

Laboratory analysis of soil chemical properties are shown in Table 4-19.

Table 4-19 Soil Chemical Properties

Sample ID	Sampling depth (cm)	pH	Salinity (%)	EC (dS/m)	Humus (%)	$CaCO_3$	$N0_3$, мг/100г	Exchangeable ion, mgeq /100gr		Mobile, mg/100gr	
								Ca^{+2}	Mg^{+2}	P_2O_5	K_2O
TSS-4	0-20 см	8.26	0.272	0.648	1.93	1.60	2.65	12	9	2.6	14
TSS-5	0-10 см	8.33	0.049	0.117	1.76	0.96	0.42	16	7	4.4	12
TSS-6	0-10 см	8.46	0.041	0.098	1.42	1.92	0.34	8	11	2.7	11
TSS-7	0-15 см	8.57	0.058	0.137	2.24	0.00	0.51	21	3	1.4	19
TSS-8	0-12 см	8.28	0.043	0.102	2.76	0.80	0.36	24	8	6.1	15
	12-30 см	8.27	0.037	0.088	1.62	2.28	0.30	10	8	4.4	12
TSS-9	0-20 см	8.23	0.041	0.097	1.73	0.80	0.34	16	4	1.5	16

According to the laboratory analysis:

Soil pH: Soil pH is used to indicate the acidity or alkalinity of soil. pH is measured from ultra acidic to very strong alkaline[96]. Soil pH level is around 8.34, ranging from 8.23 to 8.57 (see Figure 4-39) due to their geomorphological structures.

Soil electrical conductivity *(EC dS/m)*: The easily soluble salt content of the soil is classified as 0.0 to 0.75dS/m is being non- saline, 0.75 to 2.0dS/m is slightly saline, 2.0 to 4.0 dS/m moderately saline, 4.0 to 8.0dS/m is strongly saline, 8.0 to 15.0dS/m is very strongly saline [97]. According to soil layers within measured depth between 0-30 centimeters, the easily soluble content of salt varies around 0.08 to 0.64 deciSiemens per meter[98]. It is important to note that, easily soluble content of salt in the A horizon is less than AB horizon (see Figure 4-39).

***Soil carbonate (CaCO3)**:* The carbonate content of the soil layers and its distribution affects the soil quality, erosion, resistance and moisture content. The soil carbonate is classified according its depth in soil layers and its content, as 0-2 percent is being low, 2-10 percent is moderate, 10-25 percent is strong, >25 percent is very strong[99]. The carbonate content of the soils is around 1.19, ranging from 0 to 2.28 in the A and AB horizon (see Figure 4-39). The carbonate content of the soils belongs to low according to above mentioned soil carbonate classification.

Soil organic matter: The soil organic matter (SOM) is main indicator of soil nutrients. As shown in Figure 4-39, the amount of soil organic matter changes according to soil types, local hydro-climate condition and their nature formation.

Mobile (K_2O+P_2O_5): Macroelements such as nitrogen, phosphorus, and potassium, which are necessary for plant growth and development, are accumulated in the soil layers from natural and plant decomposition processes. Among these nutrients, potassium oxide

[96] USDA, 2017

[97] Food and Agriculture organization of the United Nations. 2006

[98] Soil salinity, as well as water salinity, often is measured by electrical conductivity; deciSiemens per meter is a commonly used electrical conductivity unit.

[99] Food and Agriculture organization of the United Nations. 2006

(K_2O) and phosphorus pentoxide (P_2O_5) are considered essential macronutrients for plant growth and these nutrients involved in various physiological processes, including energy transfer, photosynthesis, and the formation of structural components in plants. As for the potassium oxide (K_2O) content, <2.0mg/100gr is considered low and 2-4mg/100g is average, while for the phosphorus pentoxide content (P_2O_5), <10mg/100gr is considered low, and 10 to 20mg/100gr is sufficient. Concentrations of mobile phosphorus (as P_2O_5) is ranged between 1.4 to 6.1 milligrams per 100 grams in the A horizon of soils, whereas potassium (as K_2O) ranges 11 to 19 milligrams per 100 grams (see Figure 4-39).

Exchangeable ion ($Ca2^{+}$+$Mg2^{+}$): The content of exchangeable ion (Ca+Mg), which indicates soil fertility ranges between 3-24mg-eq/100g in the soil within the project site. Total exchangeable ion was 8-24mg-eq/100g Ca and 3-11mg-eq/100g Mg. The exchangeable ion of Ca was dominant in the soil. High content of exchangeable ion (Ca+Mg) is mainly observed in the A horizon of soils (see Figure 4-39).

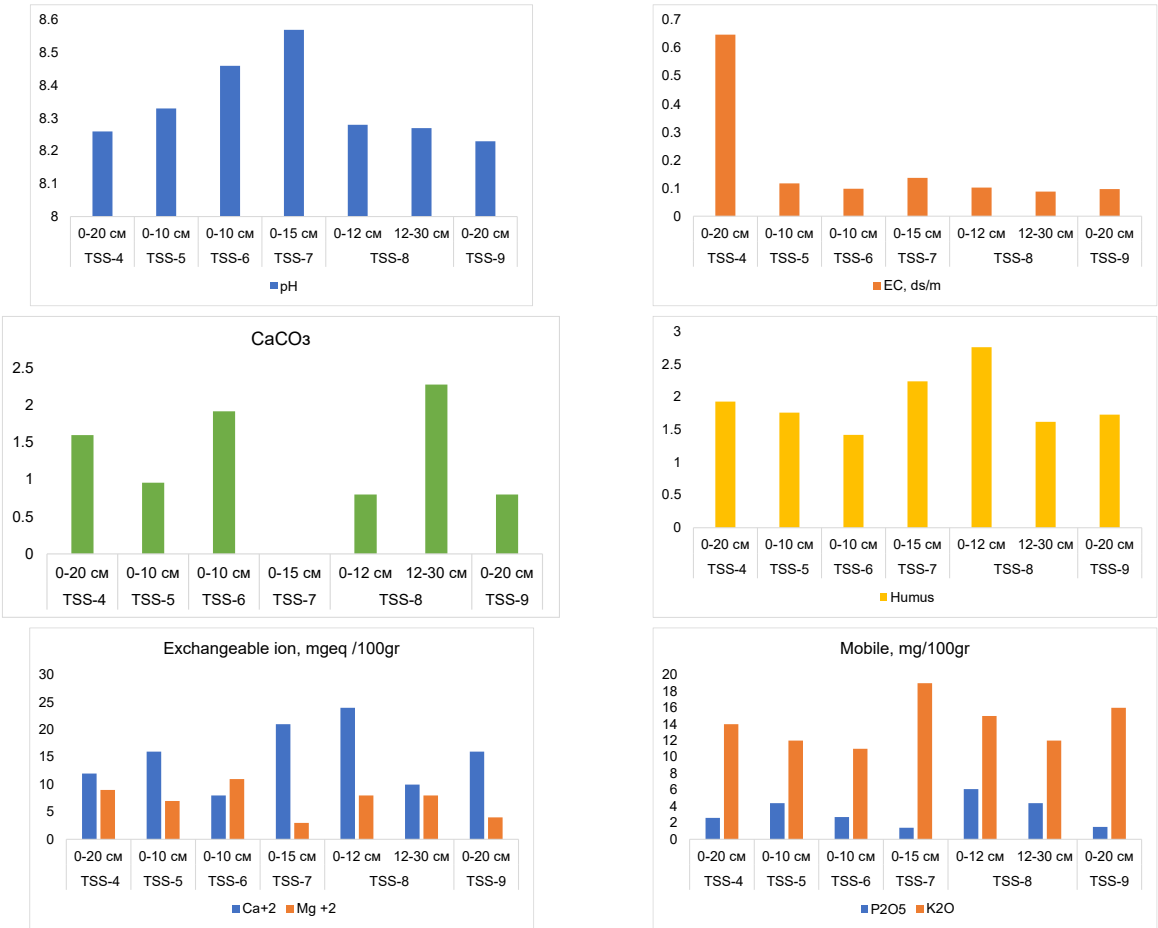


Figure 4-39 Soil Chemical Properties

4.11.2Soil Physical Properties

Laboratory analysis of soil physical properties are shown in Table 4-20 and Figure 4-40. Soil particles are formed by weathered rock. Small particles in soil layers are classified by size and according to the international classification system, sand 2.0- 0.05 mm, silt 0.05 -0.002mm and clay <0.002mm. If the clay content is less than 10% it is classified as sand, more than 10% as

silty soil and higher than >20% as heavy particles[100]. As shown in Figure 4-40, soil mechanical compositions are varing soil types and horizons.

Table 4-20 Soil Mechanical Composition

Sampling ID	Depth, см	Mechanical composition-diameter (mm), %						
		1.0-0.25	0.25-0.05	0.05-0.01	0.01-0.005	0.005-0.001	<0.001	<0.01
TSS-4	**0-20 см**	4.5	67.8	13.8	7.2	2.6	4.1	13.9
TSS-5	**0-10 см**	6.1	65.3	14.1	6.3	3.4	4.8	14.5
TSS-6	**0-10 см**	1.9	64.1	16.2	8.5	2.6	6.7	17.8
TSS-7	**0-15 см**	0	56.5	20.6	11.4	5.3	6.2	22.9
TSS-8	**0-12 см**	0.7	55.9	19.8	12.4	5.3	5.9	23.6
	12-30 см	1.4	65.1	15.3	9.7	3.2	5.3	18.2
TSS-9	**0-20 см**	0.8	58.6	18.7	10.5	4.6	6.8	21.9

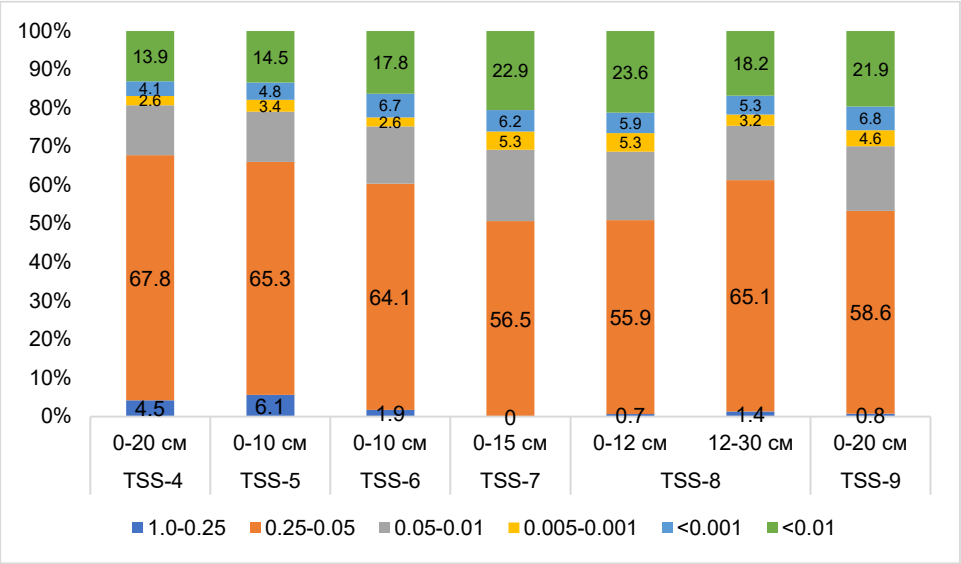


Figure 4-40 Soil Physical Properties

4.11.3 Soil Contamination

4.11.3.1 Current level of heavy metal contamination in regional soil

According to previous studies conducted within Ulaanbaatar city, the level of heavy metal contamination in the soil is higher in Khan-Uul, Bayangol, and Bayanzurkh districts compared to other districts.

Table4-21 Study on Soil Pollution in Ulaanbaatar City, 2018

District	Chromium /Cr/	Lead /Pb/	Cadmium /Cd/	Nickel /Ni/	Zinc /Zn/	Copper /Cu/
Bayangol	17.8	84.5	0.112	14.1	114.8	зо.Г"

[100] Bekhtur, 1964

District	Chromium /Cr/	Lead /Pb/	Cadmium /Cd/	Nickel /Ni/	Zinc /Zn/	Copper /Cu/
Bayanzurkh	22.7	57.1	0.204	17.1	132.3	25.1
Sukhbaatar	26.7	14.7	0.178	12.6	107.6	13.1
Songinokhairkhan	30.2	28.4	0.046	19.4	109.7	18.6
Khan-Uul	193.6	100.0	0.522	21.5	119.8	37.6
Chingeltei	31.4	11.1	0.063	13.1	116.6	11.0
Nalaikh	14.0	13.3	0.069	19.4	65.8	11.9
Ulaanbaatar city (2014)	**44.4**	**48.3**	**0.181**	**16.6**	**116.5**	**22.5**
Ulaanbaatar city (2012)	**56.4**	**33.3**	**0.570**	**9.9**	**177.5**	**39.0**
MNS 5850:2019	**150**	**100**	**3**	**150**	**300**	**100**
Source: Institutes of Geography, Geoecology, Mongolian Academy of Sciences, Soil Pollution in Ulaanbaatar City. UB, 2018.						

According to the soil hygiene analysis, heavy metals present in the soil can pose a serious threat if they accumulate in large amounts in plants, groundwater, and surface water, eventually reaching humans, livestock, and other living organisms and Such accumulation may lead to endemic diseases.

Zn, Cd, Pb, Cu, Ni, As, and Cr are among the most commonly found heavy metals in soil. These heavy metals are at elevated levels and can pose environmental and health risks (MNS5850:2019). During the field study, to collecting topsoil sampling for the heavy metal concentration in natural soil and to determine the soil pollution risk in project areas. We collecting 6 samples from each sampling point and to send laboratory for the heavy metal analysis.

According to the laboratory analytical results, the average concentrations of heavy elements in the project area are as follows: Cd <1 mg/kg, indicating a poor concentration; As – 3 to 13 mg/kg, indicating a low concentration; Ni – 12 to 27 mg/kg; Cu – 21 to 33 mg/kg; Zn – 56 to 111 mg/kg; Pb – 23 to 45 mg/kg; and Cr – 34 to 60 mg/kg. The order of concentration is Zn > Cr > Pb > Cu > Ni > As > Cd. The concentrations of heavy metals in the surface soil did not exceed the permissible limits specified in the MNS 5850:2019 standard, indicating that no contamination was detected. Accordingly, since the concentrations remained within standard limits, indices such as the pollution coefficient and geo-accumulation index were applied to assess potential environmental and health risks associated with heavy metals in soil.

4.11.3.2 Soil heavy metal contamination

Within this study, 7 soil samling are taken for heavy metals analysis. The most abundant heavy metals in nature such as Zn, Cr, Pb, Cu, Ni, As and Cd were selected and compared with Mongolian standard, and the current level of pollution was determined. The maximum allowable concentration did not exceed according to MNS 5850:2019 standard (Table 4-22).

Table 4-22 Comparison of Heavy Metal Concentration and Maximum Allowable Soil Pollutant Concentrations (MNS 5850:2019)

Heavy metals, mg/kg	Sampling ID							MNS 5850:2019
	TSS-4 (0-20 см)	TSS-5 (0-10 см)	TSS-6 (0-10 см)	TSS-7 (0-15 см)	TSS-8 (0-12 см)	TSS-8 (12-30 см)	TSS-9 (0-20 см)	
Cr	40	6.7	53.3	13.3	26.7	13.3	6.7	**150**
Pb	9.4	18.8	15.6	15.6	34.4	12.5	21.9	**100**
Cd	0	0	0	0	0	0	0	**3**
Zn	10.1	2.4	3.3	6.6	55.8	5.5	2.9	**300**
Cu	1.5	1	1.3	3.3	20	1.5	0.3	**100**
Ni	0.4	0	0.8	2.8	21.1	1.6	0.4	**150**

4.11.3.3 Soil hygiene

According to sanitary microbiological analysis, the presence of Escherichia coli (E. coli) and anaerobes such as *Clostridium perfringens* in the soil indicates contamination with fecal matter. These microorganisms are naturally found in the human intestinal tract and enter the soil through feces. Soil can temporarily serve as a habitat for these bacteria, which may then spread through air, soil, or contaminated hands, potentially causing serious infectious diseases.

Escherichia coli (E.coli) and Anaerobes (Cl.perfringens) are used Soil microbiological analysis and its contamination level. The results of laboratory analysis are shown in Table 4-23. As shown in Table 4-23, according to the results of the soil hygiene analysis, the number of bacteria in the soil ranges from from $3.5*10^5$ to $4.6*10^5$.

Table 4-23 Soil microbiology (1 gr soil)

Sampling ID	Depth.cm	Bateria counts	E.coli: MNS 3297:2019		Cl.perfringens MNS 3297:2019	
		Results	Results	Contamination level	Results	Contamination level
TSS-4	0-20 см	$4.3*10^5$	≥0.1	1	≥0.1	1
TSS-5	0-10 см	$4.1*10^5$	≥0.1	1	≥0.1	1
TSS-6	0-10 см	$4.0*10^5$	≥0.1	1	≥0.1	1
TSS-7	0-15 см	$4.5*10^5$	≥0.1	1	≥0.1	1
TSS-8	0-12 см	$4.6*10^5$	≥0.1	1	≥0.1	1
	12-30 см	$4.0*10^5$	≥0.1	1	≥0.1	1
TSS-9	0-20 см	$3.5*10^5$	≥0.1	1	≥0.1	1

4.12 Vegetation cover

The “Ulaanbaatar Public Transport (Light Rail Transit–LRT) from the General Archives to Sukhbaatar Square” project is being implemented in areas of Ulaanbaatar city where the population is concentrated and infrastructure is relatively well developed. The project area spans across the territories of Sukhbaatar and Khan-Uul districts of Ulaanbaatar city, running along paved roads in residential zones with high population density. This project area largely overlaps with the area studied under the previous “Selbe Revival” project. Therefore, in this environmental baseline assessment report, the characteristics of the vegetation cover have been identified based on the findings of the previous study[101].

The study area, located in the vicinity of Ulaanbaatar city, falls within the transitional zone between the Khentii Mountain range and the Mongol Daguur steppe according to the 16th range of flora and geographical Mongolia. In terms of vegetation, the area is notably influenced by the taiga forest and mountain forest-steppe vegetation of the Khentii Mountains from the north, while from the south, it is affected by the typical feather grass steppe vegetation of the Central Khalkh steppe region. This unique overlap of floristic characteristics makes the area significantly distinct from other regions.

This region encompasses the peripheral ranges of the Khentii Mountains and partially encircles the Khentii Mountain taiga region in a semicircular pattern. It includes the areas along the river valleys of the Onon, Ulz, Tuul, Kharaa, and Yuruu rivers that surround the Khentii Mountains. The study site falls within the Bogd Khan Mountain and Tuul River valley subregion of this region. The project site falls within the mountain steppe vegetation community characterized by grass-herb of

[101] BGM Distribution LLC, 2023. Detailed Environmental Impact Assessment for the Selbe Sergelt Project.

mountainous steppe ecosystems. This area is notable for containing around 50 flora species unique to this specific zone. Located near the Nukht Valley of Bogd Khan Mountain, the site is ecologically influenced from the upper slopes by mountain forests and forest-steppe, and from the lower slopes by riparian meadows with sedge-herb vegetation. As a result, grass-forb dominated mountain steppe vegetation is widely distributed in the area.

In and around the Nukht Valley, three main types of flora communities can be observed:

- Sedge-herb dominated mountain steppe vegetation;
- River floodplain meadows with sedge-herb associations found in transition zones;
- Forest-steppe vegetation featuring pine, birch, and grass species.

Key representative species found in this region include Cerastium dahuricum Fisch, Betula mandschurica, Veronica dahurica, Larix gmelinii, Betula mongolica, Poa supina, Koeleria glauca, Polygonum heterophylla, Cerastium dahurium, Sophoria flavescens, Potentilla norvegica, Eryngium planum, Lilium pensylvanicum, Pulsatilla astragalifolia, Melilotus albus, Trifolium pratense, Granium pratense, Ranunculus gmelinii, Astragalus chinensis, Orchis militarus, Gentiana dahurica, Taraxacum bornuurense, Veronica krylovii, Artemisia selengensis. However, the general baseline, characteristics, and species composition of the flora in the area surrounding Ulaanbaatar have significantly changed due to the influence of the central settlement zone. As a result, the natural vegetation has largely lost its original characteristics, and anthropogenic and weed grass species, such as various species of Artemisia and Chenopodium, have become dominant.

According to the results of previous survey[102], the area around the “Ulaanbaatar Public Transport (Light Rail Transit–LRT) from the General Archives to Sukhbaatar Square” project is predominantly covered by feather grass–lyme grass–mixed herb vegetation in the floodplain meadows of the Selbe River. However, due to the influence of urban settlement, the vegetation cover has been significantly degraded, resulting in bare soil lacking vegetation.

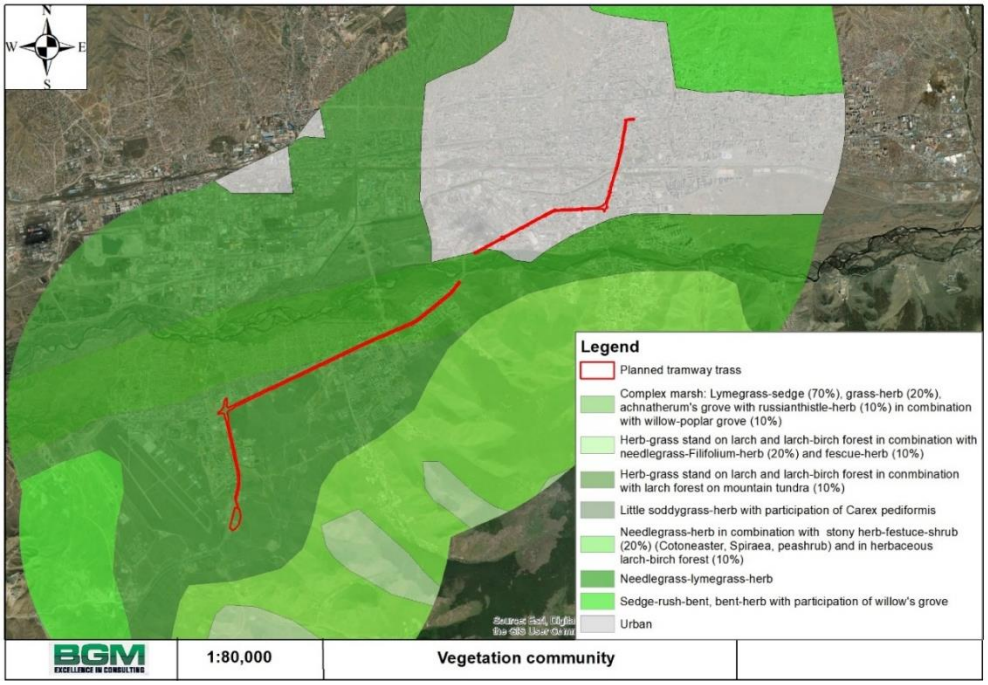


Figure 4-41 Vegetation community of Project area

[102] BGM Distribution, 2023

4.12.1 Species composition

Based on previous studies[103], over 200 species of 141 genera and 42 families in the “Ulaanbaatar Public Transport (Light Rail Transit-LRT) from General Archives to Sukhbaatar Square” project area could be occurred.

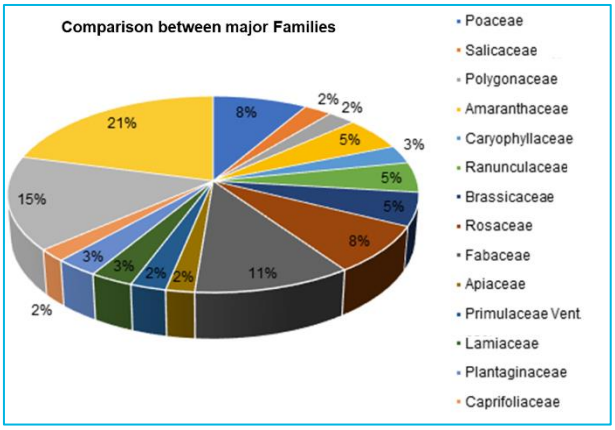


Figure 4-42 The proportion of species belonging to major families

When comparing the more than 200 documented in the project area by major families, the Asteraceae is the most dominant, comprising 31 species or 15% of the total species. It is followed by Fabaceae with 22 species (11%), Rosaceae with 16 species (8%), Poaceae with 17 species (8%), and Ranunculaceae, Brassicaceae, and Amaranthaceae each comprising about 5%. Other families make up 2–3% of the total. Minor families with only 1–3 species account for 21% of the total species. In terms of genera, Asteraceae also ranks first with 16 genera, followed by Poaceae with 14, Brassicaceae with 11, and Rosaceae with 10 genera. The most dominant genera in terms of species richness are Artemisia and Chenopodium, which are characteristic of ruderal and disturbed habitats.

Table 4-24 Number of species, genera and proportion of major families

№	Familty nams	Number of genera	Number of species	Percentage
1	Poaceae- Үетний овог	14	17	8%
2	Salicaceae-Бургасны овог	2	5	2%
3	Polygonaceae-Тарнын овог	3	5	2%
4	Amaranthaceae-Гагадайтан	8	11	5%
5	Caryophyllaceae-Баширтан	5	6	3%
6	Ranunculaceae-Холтсонцэцэгтэн	9	10	5%
7	Brassicaceae-Байцаатан	11	11	5%
8	Rosaceae-Сарнайтан	10	16	8%
9	Fabaceae-Буурцагтан	9	22	11%
10	Apiaceae-Шүхэртэн	4	4	2%
11	Primulaceae Vent. – Хаварсалын овог	5	5	3%
12	Lamiaceae-Уруул цэцэгтэн	6	6	3%
13	Plantaginaceae-Таван салааны овог	3	6	3%
14	Caprifoliaceae-Даланхальстан	3	4	2%
15	Asteraceae-Нийлмэл цэцэгтэн	16	31	15%

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№	Familty nams	Number of genera	Number of species	Percentage
16	Other family	33	42	21%
17	**Нийт**	**141**	**201**	**100%**

The list of flora species composition was compiled by consolidating the results of the author's previous research conducted in the vicinity of Ulaanbaatar city, along with results from survey and analyses carried out by other researchers.

Table 4-25 Summaries of Vegetation composition and characteristics in study area

Family	Genus	Species	Name of species	Mountain steppe	Meadow	Weed grass	Life from
			Pinaceae-Нарсны овог				
1	1	1	*Picea obovata*-Сибирь Гацуур	Planted			Tree
	2	2	*Pinus silvestris L*-Эгэл Нарс	Planted			Tree
	3	3	*Larix sibirica Ledeb-Сибирь Шинэс*	Planted			Tree
			Poaceae- Үетний овог				
2	4	4	*Setaria viridis*-Ногоон хоног будаа		+		Annual
	5	5	*Achnatherum splendens*-Гялгар дэрс		+		Perennial/shrub
	6	6	*Stipa baicalensis*-Байгалийн хялгана	+			Perennial/shrub
		7	*S.krylovii*-Крыловын Х.	+			Perennial/shrub
	7	8	*Cliestogenes squarrosa*-Д/хазаар өвс	+			Perennial/shrub
	8	9	*Eragrostis minor*-Бага Хургалж			+	Annual
	9	10	*Koeleria macrantha*- Т/цэцэгт дааган сүүл	+			Perennial/shrub
	10	11	*Poa botrvoides*-Цацаглиг Биелэг өвс	+			Perennial/shrub
		12	*P.pratensis L*-Нугын Биелэг				Perennial/shrub
	11	13	*Agrostis mongholica*-Монгол улаан толгой	+			Perennial/shrub
	12	14	*Festuca lenensis*-Лени Ботууль	+			Perennial/shrub
	13	15	*Bromus inermis*-Соргүй согоовор	+			Perennial/shrub
	14	16	*Agropyron cristatum*-Саман ерхөг	+			Perennial/shrub
	15	17	*Elymus chinensis*-Нангиад цагаан суль.түнгэ	+			Perennial/shrub
		18	*E.dahuricus*-Дагуур Ц.С.	+			Perennial/shrub
	16	19	*Chloris virgata Sw.*- Саваан булган сүүл				Annual
	17	20	*Phragmites communis Trin.*-Эгэл нишингэ				Perennial/shrub
			Cyperaceae-Улалжийн овог				
3	18	21	*Carex duriuscula*-Ширэг улалж	+	+	+	Perennial/shrub
		22	*C. pediformis*-Зогдор У.	+	+		Perennial/shrub
			Amaryllidaceae-Амариллисын овог				
4	19	23	*Allium bidentatum*-Шүдлэг сонгино	+			Perennial/shrub
		24	*A.anisopodium*-Шувуун хөл		+		Perennial/shrub
			Asparagaceae-Хэрээн нүдний овог				
5	20	25	*Asparagus dahuricus*-Дагуур хэрээнүд	+			Perennial/shrub
			Iridaceae-Цахилдагны овог				
6	21	26	*Iris lactea*-Цагаалин Цахилдаг		+		Perennial/shrub
			Salicaceae-Бургасны овог				
7	22	27	*Salix pentandra*-Таван дохиурт Бургас		+		Tree
		28	*S.caspica*-Цагаан Бургас		+		Tree
	23	29	*Populus tremula*-Улиангар		+		Tree
		30	*Populus Laurifolia Ldb.*-Лавар навчит Улиас	Planted			Tree
		31	*Populus alba.*-Мөнгөлөг Улиас	Planted			Tree
			Betulaceae-Хусны овог				
8	24	32	*Betula platyphylla*-Хавтага навчит хус	+	+		Tree
			Ulmaceae-Хайлаасны овог				

Family	Genus	Species	Name of species	Mountain steppe	Meadow	Weed grass	Life from
9	25	33	*Ulmus pumila*-Одой хайлаас	Planted			Tree
			Oleaceae-Чидуны овог				
10	26	34	*Syringa sp*-Голт бор	Planted			Tree
			Urticaceae-Халгайн овог				
11	27	35	*Urtica angustifolia*-Н/навчит халгай			+	Perennial/shrub
			Polygonaceae-Тарнын овог				
12	28	36	*Polygonum alopecuroides*-Ү/сүүлхэй Т	+			Perennial/shrub
		37	*P.aviculare*-Шувуун Т.		+	+	Annual
		38	*P.convolvulus*-Сэдэргэнэн Т.	+			Annual
	29	39	*Rheum undulatum*-Долгиотсон Гишүүнэ	+		+	Perennial/shrub
	30	40	*Rumex thyrsiflorus*-Цацаган хурган чих	+			Perennial/shrub
			Amaranthaceae-Гагадайтан				
13	31	41	*Chenopodium acuminatum*-Шоргор лууль			+	Annual
		42	*Ch.album*-Цагаан Л.			+	Annual
		43	*Ch.glaucum*-Хөхногоон Л.			+	Annual
		44	*Ch.aristatum*-Сортой Л.			+	Annual
	32	45	*Atriplex sibirica*-Сибирь Шорной			+	Annual
	33	46	*Bassia dasyphylla*-Үсхий мананхамхаг			+	Annual
	34	47	*Kochia densiflora*- Б/цэцэгт Тогторгоно			+	Annual
	35	48	*Corispermum monqolicum*- М/ хамхуул			+	Annual
	36	49	*Suaeda corniculata*-Эвэрт бударга			+	Annual
	37	50	*Salsola collina*-Толгодын бударгана			+	Annual
	38	51	*Amaranthus retroflexus*-Урвуу гагадай	+			Annual
			Caryophyllaceae-Баширтан				
14	39	52	*Stellaria dichotoma*-Ацан ажигана	+			Perennial/shrub
	40	53	*Arenaria capillaris*-Дэвхэргийн цагаан	+			Perennial/shrub
	41	54	*Silene jenisseensis*-Енисейн Шээрэнгэ	+			Perennial/shrub
		55	*S.repens*-Мөлхөө Ш.	+			Perennial/shrub
	42	56	*Gypsophila dahurica*-Дэгүүр Тайр	+			Perennial/shrub
	43	57	*Dianthus versicolor*-Алагцэцэгт Башир	+			Perennial/shrub
			Ranunculaceae-Холтсонцэцэгтэн				
15	44	58	*Caltha palustris*-Намгийн Бальви	+			Perennial/shrub
	45	59	*Trollius asiaticus*-Азийн Жамьяанмядаг	+	+		Perennial/shrub
	46	60	*Delphinium grandoflorum*-Т/цэцэгт гэзэг цэцэг	+			Perennial/shrub
	47	61	*Aconitum barbatum*-Шар хорс	+			Perennial/shrub
	48	62	*Pulsatilla turczaninovii Kryl.* -Хөх яргуй	+			Perennial/shrub
	49	63	*Atrogene sibirica*-Сибирь чөдөр өвс	+			Perennial/shrub
	50	64	*Halespestes salsuginosa*-Марцны гэц	+			Perennial/shrub
	51	65	*Ranunculus japonicas*-Япон холтсонцэцэг		+		Perennial/shrub
		66	*R.repense*-Мөлхөө Х.Ц.		+		Perennial/shrub
	52	67	*Berberis sibirica*-Сибирь тошлог, шар мод	+			Shrub
			Papaveraceae-Намуугийн овог				
16	53	68	*Papaver mudicaule*-Нүцгэн намуу	+			Perennial/shrub
	54	69	*Corydalis sibirica*-Сибирь савалгана	+			Perennial/shrub
			Brassicaceae-Байцаатан				
17	55	70	*Brassica camestric*-Зэрлэг байцаа	+			Annual
	56	71	*Thlaspi arvensis*-Хөдөөний бираага	+			Annual
	57	72	*Alyssum lenense*-Лени шар дэмэг	+			Perennial/shrub
	58	73	*Ptilotrichum canescens*-Буурал Янгиц	+			Perennial/shrub
	59	74	*Draba nemorosa*-Тужийн хамбил			+	Annual
	60	75	*Arabis pendula*-Санжгар шувтаахай, барбөг	+			Perennial/shrub

Family	Genus	Species	Name of species	Mountain steppe	Meadow	Weed grass	Life from
	61	76	*Dontostemon integrifolius*-Б/навчит Багдай			+	Annual
	62	77	*Clausia aprica*-Нарсаг бүрзэг	+			Perennial/shrub
	63	78	*Erysimum flavum*-Шар гонтог	+			Perennial/shrub
	64	79	*Sisymbrium heteromallum*- Элдэвүрт хамбай			+	Annual
	65	80	*Descuraina sophia*-Софийн барбут			+	Annual
			Crassulaceae-Зузаалайтан				
18	66	81	*Sedum aizoon-Үлдэн могойн идээ*	+			Perennial/shrub
	67	82	*Orostachys fimbriata-Цэцэгт үлд өвс*	+			Perennial/shrub
		83	*O.spinosa-Хамгуурт Ү.Ө*	+			Perennial/shrub
			Celastraceae				
19	68	84	*Parnassia palustris*-Намгийн дүндэггарав		+		Perennial/shrub
			Grossulariaceae-Тошлойтон				
20	69	85	*Ribes diacantha*-Тэхийн шээг	+			Shrub
			Rosaceae-Сарнайтан				
21	70	86	*Spiraea aquileqifolia*-У/навчит Тавилгана	+			Shrub
	71	87	*Cotoneaster melanocarpa*-Хар үрт чаргай	+			Tree
	72	88	*Potentilla anserina*-Галуун гичгэнэ		+		Perennial/shrub
		89	*P.acualis*-Ишгүй Г.				Perennial/shrub
		90	*P.multifide*-Хигмэл Г.		+		Perennial/shrub
		91	*P.sericea*-Торгон Г.		+		Perennial/shrub
		92	*P.conferta*-Бөөнөг Г.		+		Perennial/shrub
		93	*P.tanacetifolia*-Мараахай навчит Г.		+		Perennial/shrub
		94	*P.viscosa*-Наалданги Г.		+		Perennial/shrub
	73	95	*Sibbaldianthe adpressa*- Н/ хэрээнхошуу	+			Perennial/shrub
	74	96	*Chamaerhodes erecta*-Цэх Түмэн тана	+			Perennial/shrub
	75	97	*Sanquisorba officinalis*-Эмийн сөд		+		Perennial/shrub
	76	98	*Rosa acicularis*-Өргөс нохойн хошуу	+			Shrub
	77	99	*Amyqdalus pedunculata*- Бариулт бүйлэс	Planted			Shrub
	78	100	*Armenica sibirica L. Lam*-Сибирь гүйлс	Planted			Shrub
	79	101	*Padus asiatica Kom*-Азийн Монос	Planted			Tree
			Fabaceae-Буурцагтан				
22	80	102	*Thermopsis dahurica*- Дагуур тарваган шийр	+			Perennial/shrub
	81	103	*Medicaqo falcate*- Шар царгас	+			Perennial/shrub
	82	104	*Melilotus suaveolens*-Үнэрт хошоон	+			Perennial/shrub
	83	105	*Trifolium lupinaster*-Шошлойрхог хошоонгор	+			Perennial/shrub
	84	106	*Caraqana pyqmae*-Тарваган харгана	+			Shrub
		107	*C.microphylla*-Жижигнавчит Х.	+			Shrub
		108	*C.arborescens. Lam*-Шар хуайс	Planted			Shrub
	85	109	*Astraqalus adsurqens*-Нумраа хунчир	+			Perennial/shrub
		110	*A.membranaceus*-Сарьслаг Х.	+			Perennial/shrub
		111	*A.melilotoides*-Хошоон Х.	+			Perennial/shrub
		112	*A.inopinatus*-Дайралдмал Х.	+			Perennial/shrub
		113	*A.qalactites*-Цагаан Х.			+	Perennial/shrub
	86	114	*Oxytropis filiformis*-Утсан ортууз	+			Perennial/shrub
		115	*O.glabra*-Нүцгэн О.	+			Perennial/shrub
		116	*O.myriophylla*-Түмэннавчинцарт О.	+			Perennial/shrub
		117	*O.nitens*-Гялгар О.	+			Perennial/shrub
		118	*O.caespitosa*-Дэгнүүлт О.	+			Perennial/shrub
		119	*O.strobilacea*-Боргоцойрхуу О.	+			Perennial/shrub
	87	120	*Vicia multicaulis*-Олон ишт Гиш	+			Perennial/shrub
		121	*V.cracca*-Хулганын Г.	+			Perennial/shrub

Family	Genus	Species	Name of species	Mountain steppe	Meadow	Weed grass	Life from
	88	122	*Lathyrus humilis*-Намхан Төмөрдээ		+		Perennial/shrub
		123	*L.palustris*-Намгийн Т.		+		Perennial/shrub
			Geraniaceae-Шимтэглэйтэн				
23	89	124	*Geranium sibiricum*-Сибирь шимтэглэй		+		
		125	*G.pratense*-Нугын Ш.		+		Perennial/shrub
	90	126	*Erodium stephanianum*- Стефаны Заантаваг			+	Perennial/shrub
			Euphorbiaceae-Сүүтэн				
24	91	127	*Euphorbia discolor*-Алагсүүт евс			+	Perennial/shrub
			Malvaceae-Жамбатан				
25	92	128	*Malva mohileviensis*-Могилевын Жамба			+	Annual
			Tamaricaceae-Сухайтан				
26	93	129	*Myricaria longifolia*-Урт навчит Балгана	+			Perennial/shrub
			Thymelaeaceae-				
27	94	130	*Stellera chamaejasme*-Одой Далан түрүү	+			Perennial/shrub
			Elaeagnaceae -Жигдтэн				
28	95	131	*Hippophae rhamnoides*- Яшилдуу чацаргана	Planted			Tree
			Onagraceae-Хөвөнтийн овог				
29	96	132	*Chamaenerion angustifolium*-Нар/навчит хөвөнт	+			Perennial/shrub
			Apiaceae-Шүхэртэн				
30	97	133	*Sphallerocarpus gracillis*-Өндөр үхэр гоньд		+		Annual
	98	134	*Bupleurum scorzonerifolium*-Хависхана навчит бэриш	+			Perennial/shrub
	99	135	*Carum buriaticum*-Буриад гоньд		+		Perennial/shrub
	100	136	*Peucedanum salinum*-Марцны жав		+		Perennial/shrub
			Primulaceae Vent. – Хаварсалын овог				
31	101	137	*Primula farinose*-Буурал хавсрал	+			Perennial/shrub
		138	*P.nutans*-Бөхөгөр Х.	+			Perennial/shrub
	102	139	*Androsace septentrionalis*-Умар/далан товч		+		Annual
		140	*A.incana*-Буурал Д.Т.		+		Perennial/shrub
	103	141	*Glauxmaritima*-марцны цэгээлж		+		Perennial/shrub
			Plumbaginaceae-Хорголжинтон				
32	104	142	*Goniolimon speciosum*-Гоо юлт	+			Perennial/shrub
	105	143	*Limonium flexuosum*-Тахир бэрмэг	+			Perennial/shrub
			Gentianaceae-Дэгдтэн				
33	106	144	*Gentiana decumbens*-Хэвтээ дэгд	+			Perennial/shrub
		145	*G.squarrosa*-Дэрвээн Д.	+			Annual
			Convolvulaceae-Сэдэргэнэтэн				
34	107	146	*Convolvulus ammanu*-Амманы сэдэргэнэ			+	Perennial/shrub
		147	*C.arvensis*-Чөдөр С.			+	Perennial/shrub
			Boraginaceae- Ноцоргонын овог				
35	108	148	*Lappula myosotis*-Д/цэцэгэрхүү Ноцоргоно			+	Annual
	109	149	*Amblynotus rupestris*-Хадны Бөгтөргөнө	+			Perennial/shrub
			Lamiaceae-Уруул цэцэгтэн				
36	110	150	*Scutellaria scordifolia*-Царсан гүүнхөх	+			Perennial/shrub
	111	151	*Schizonepeta multifida*- Хэрчлээст бивлэнцэр	+			Perennial/shrub
	112	152	*Dracocephalum foetidum*- Үмхий шимэлдэг			+	Annual
	113	153	*Phlomis tuberosa*-Булцуут туйпланцар	+			Perennial/shrub
	114	154	*Panzeria lanata*-Үсхий нохойхэл			+	Perennial/shrub
	115	155	*Thymus dahuricus*-Дагуур ганга	+			Shrub
			Orobanchaceae- Гувшаахайтан				

Family	Genus	Species	Name of species	Mountain steppe	Meadow	Weed grass	Life from
37	116	156	*Pedicularis flava*-Шар навчит хувиланги	+			Perennial/shrub
		157	*P.myriophylla*-Түмэннавчит Х.	+			Perennial/shrub
	117	158	*Cymbaria dahurica*-Дагуур хатны цэцэг	+			Perennial/shrub
			Plantaginaceae-Таван салааны овог				
38	118	159	*Plantago major*-Их таван салаа		+		Perennial/shrub
		160	*P.depressa*-Навтгар Т.С			+	Perennial/shrub
	119	161	*Linaria buriatica*-Буриад хонин зажлуур	+			Perennial/shrub
		162	*L.acutiliba*-Хурц салбант Х.З	+			Perennial/shrub
	120	163	*Veronica incana*-Буурал гандбадраа	+			Perennial/shrub
		164	*V.lonqifolia*-Уртнавчит Г.		+		Perennial/shrub
			Rubiaceae Juss. – Ягаандайн овог				
39	121	165	*Galium verum*-Жинхэнэ өрөмтуул	+			Perennial/shrub
			Caprifoliaceae-Даланхальстан				
40	122	166	*Valeriana officinalis*-Эмийн бамбай	+			Perennial/shrub
	123	167	*Patrinia sibirica*- Сибирь сэрхэлиг	+			Perennial/shrub
		168	*P.rupestris*-Хадны С.	+			Perennial/shrub
	124	169	*Scabiosa comosa*-Цомцогт бэрцэцэг	+			Perennial/shrub
			Campanulaceae-Хонхонцэцэгтэн				
41	125	170	*Adenophora stenanthiana*-Н/цэцэгт хонхлой	+			Perennial/shrub
			Asteraceae-Нийлмэл цэцэгтэн				
42	126	171	*Heteropappus altaicus*-Алтайн согсоолж	+			Perennial/shrub
		172	*H.nispidus*-Арзгар С.			+	Perennial/shrub
	127	173	*Aster alpinus*-Тэгийн гол гэсэр	+			Perennial/shrub
	128	174	*Leontopodium ieontopodoides*-Э/цагаан түрүү	+			Perennial/shrub
	129	175	*Inula britannica*-Британи зоосонцэцэг		+		Perennial/shrub
	130	176	*Achillea asiatica*-Азийн төлөгч өвс	+	+		Perennial/shrub
	131	177	*Chrysanthemum zawadskii*- Завадскийн тунхуу	+			Perennial/shrub
	132	178	*Artemisia dracunculus*-Ишгэн шарилж			+	Perennial/shrub
		179	*A.glauca Pall.* -Саарал Ш.			+	Perennial/shrub
		180	*A.pectinata*-Шүлхий Ш.			+	Annual
		181	*A.macrocephala*-Ээрэм Ш., царван			+	Annual
		182	*A.sieversiana*-Сэверсийн Ш.			+	Annual
		183	*A.scoparia*-Ямаан Ш.			+	Annual
		184	*A.annua*-Зуны Ш.			+	Annual
		185	*A.santolinifolia*-Кантолиннавчит Ш.,			+	Perennial/shrub
		186	*A.mongoiica*-Монгол Ш.			+	Perennial/shrub
		187	*A.frigida*-Агь Ш.	+		+	Perennial/shrub
		188	*A.adamsii*-Адамсын Ш.			+	Perennial/shrub
		189	*A.commutata*-Хурган Ш.			+	Perennial/shrub
	133	190	*Echinops latifolius*-Ө/навчитТайжийн жинс	+			Perennial/shrub
	134	191	*Saussurea amara*-Гашуун Банздоо			+	Perennial/shrub
		192	*S.salicifolia*-Бургаснавчит Б.			+	Perennial/shrub
	135	193	*Cirsium esculentum*-Иддэг азаргана		+		Perennial/shrub
	136	194	*Serratula centauroides*-Хонгорзуллиг Хонгорзалаа	+			Perennial/shrub
	137	195	*Scorzonera radiata*-Цацрагт хависгана	+		+	Perennial/shrub
	138	196	*Souchus arvensis*-Хөдөөний Шаралзгана	+			Perennial/shrub
	139	197	*Youngia tennifolia*-Нарийннавчит Юнги	+			Perennial/shrub
	140	198	*Taraxacum collinum*-Толгодын багваахай		+	+	Perennial/shrub

Family	Genus	Species	Name of species	Mountain steppe	Meadow	Weed grass	Life from
		199	*T.officinalis*-Эмийн Б.		+	+	Perennial/shrub
		200	*T.leucanthum*-Цагаанцэцэгт Б.		+		Perennial/shrub
	141	201	*Crepos crocea*-Гүргэм шар банга	+			Perennial/shrub

Based on life forms, the plants potentially occurring in the study area consist of 71% perennial herbaceous plants, 16% annual and short-lived herbaceous plants, 7% woody (tree) plants, and 6% shrubs, subshrubs, and shrub-like plants of the total flora.

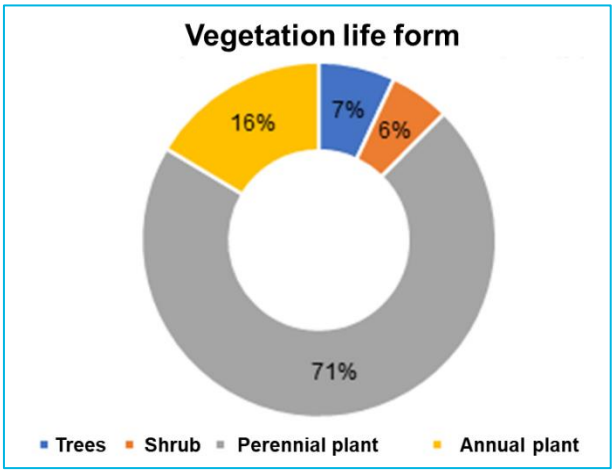

Figure 4-43 Vegetation life form in the project area

4.13 Forest

4.13.1 Survey method

The forest survey within the project area of the “Ulaanbaatar Light Rail Transit (LRT) from General Archives to Sukhbaatar Square” was conducted by forestry specialists from Green Forest LLC. As part of this, a survey was carried out to inventory the trees and shrubs located along the designated alignment of the LRT-I line construction area and to assess their ecological and economic value. The Urban Planning and Research Institute identified the green areas along the planned route and recorded the locations of existing trees. Each tree and shrub was classified by species, and their height and diameter were measured. A written record was made to determine whether each individual plant could be transplanted[104]. Tree heights were measured using a clinomaster device integrated with a Vertex instrument, which determines height based on distance and angle measurements. The distance from the observer to the tree was measured using ultrasonic and infrared signals through a transponder and rangefinder system mounted on the tree. Shrub heights were measured manually using a measuring tape[105].

[104] New Green Forest, 2025. “Ecological-Economic Valuation of Vegetation in Green Spaces within the Road Expansion and Improvement Zone of the Ulaanbaatar LRT Line II Project Page 5

[105] New Green Forest, 2025. “Ecological-Economic Valuation of Vegetation in Green Spaces within the Road Expansion and Improvement Zone of the Ulaanbaatar LRT Line II Project” Page 5

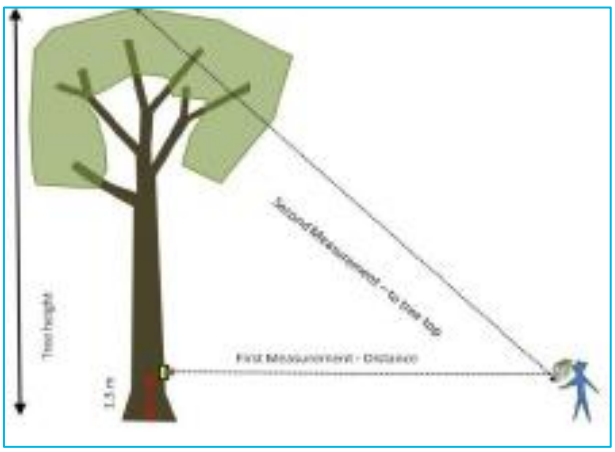

Figure 4-44 Measurement method of tree height

The diameter of each tree trunk was measured at 1.3 meters above ground level. For shrubs, the average diameter was determined by measuring the stems at the base. Tree and shrub diameters were measured using a diameter tape (D-tape). There is currently no specific methodology in place in Mongolia for calculating the ecological and economic value of trees and shrubs growing in green spaces.

The ecological and economic valuation of trees and shrubs was determined based on the pricing and tax schedule approved by Resolution No. 18 of the Citizens' Representative Khural of Ulaanbaatar City, dated January 24, 2007, titled "Rates and tax applicable to the restoration and compensation of damages to public utilities and green areas." This valuation is grounded in Articles 20.1.3 and 20.1.7 of the Law of Mongolia on the Administrative and Territorial Units and Their Governance. As of nowadays, the above mentioned valuation continues to be used in Ulaanbaatar for addressing and restoring damages to public utilities and urban green spaces[106].

Site of survey: "As part of the Light Rail Transit (LRT) Line II project in Ulaanbaatar, a road expansion and improvement will be carried out along a 15.0 km long and approximately 800 m wide corridor, extending from the southern parking area of Sukhbaatar Square to the General Archives Authority. This corridor covers a total area of 1,272.83 hectares. Within this planned area, a tree and shrub inventory was conducted by walking survey along the proposed alignment.

According to the study, the implementation of the Light Rail Transit (LRT) Line I project in Ulaanbaatar specifically within the road expansion and improvement area will affect public green spaces located alongside the 15 km alignment. This alignment stretches from Sukhbaatar Square within the territories of 1st and 2nd khoroos of Sukhbaatar district to the General Archives Authority located in 8th khoroo of Khan-Uul district

[106] New Green Forest, 2025. "Ecological-Economic Valuation of Vegetation in Green Spaces within the Road Expansion and Improvement Zone of the Ulaanbaatar LRT Line II Project" Page 6

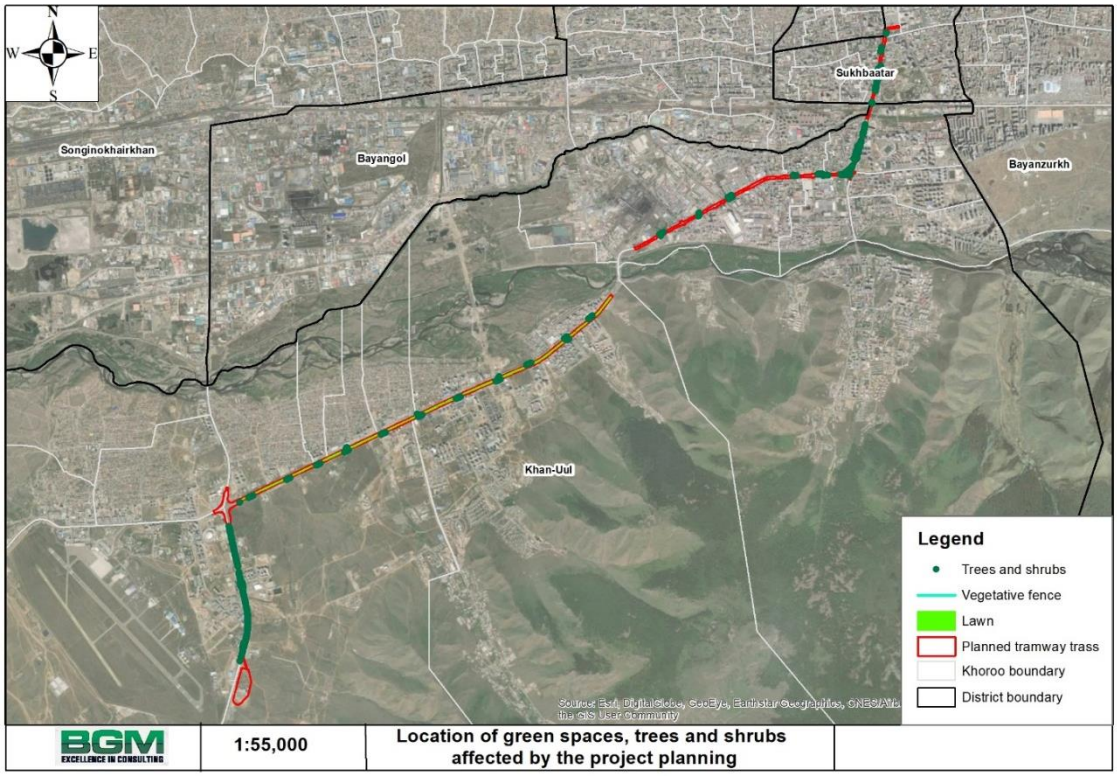

Figure 4-45 Green spaces, trees and shrubs of Project area

4.13.2 Green space in project area

As part of the construction activities for the LRT-II line of the "Ulaanbaatar Light Rail Transit (LRT) from General Archives to Sukhbaatar Square" project, road expansion and reconstruction will be carried out over an area extending 15.0 km in length and 800 m in width from the southern parking area of Sukhbaatar Square to the General Archives Authority covering a total area of 1,272.83 hectares. This includes public green spaces located along the roadside from Khoroos 1 and 2 of Sukhbaatar District to Khoroo 8 of Khan-Uul District, which will be affected by the project activities (See Table 4-26). According to Table 2-25, within the total 1,272.83 ha project area, 60,256 m² of publicly owned green space with grass cover and 8,453 trees and shrubs of 15 different species planted individually, in groups, or as hedgerows are present. Of these, 3,405 trees and shrubs of 15 species and 60,256 m² of lawn area are expected to be directly impacted. The inventoried green spaces consist of 3 species of coniferous trees, 3 species of deciduous trees, and 9 species of shrubs, planted in areas along pedestrian walkways and road medians where tree planting is feasible.

Table 4-26 Green space information of growthing in project area

№	Project location	Khoroo	Total area /ha/	Green space to affect activities		
				Vegetation fence */m/*	Lawn */m²/*	Trees and shrub */unit/*
1	Road expansion and renovation area as part of the LRT-II line construction project	01, 02, 03, 04, 05, 06, 07, 08, 15, 18, 19, 20, 21, 22, 23, 24, and 25th khoroo of Khan-Uul district, 1 and 2nd khoroo of Sukhbaatar district, 03 and 26th khoroo of Bayangol district	1272.83	951	60256	3405
Total			**1272.83**	**951**	**60256**	**3405**

Table 4-27 Green space in project area

№	Type of tree	Measurement unit	Number	Average diameter /cm/	Average height /m/	Number of possible to resettlement trees (unit)	Number of impossible to resettlement trees (unit)
1	*Acer tataricum*	Unit	1	4	5	1	0
2	*Dasiphora fruticose L*	Unit	54	6	4	14	40
3	*Salix triandra L.*	Unit	7	1	3	0	7
4	*Picea obovate L.*	Unit	39	4	2	29	10
5	*Syringa josikaea Jacg*	Unit	938	1	1	440	498
6	*Armenica Sibirica.Lan*	Unit	33	1	1	21	12
7	*Padus asiaticus*	Unit	7	3	7	0	7
8	*Pinus silvestris L*	Unit	691	8	6	8	683
9	*Rosa acicularis L.*	Unit	15	1	1	3	12
10	*Malus Pallasiana Jiz*	Unit	2	2	2	0	2
11	*Ribes diacantia L*	Unit	396	1	1	381	15
12	*Populus suaveolens Fisch*	Unit	187	15	9	0	187
13	*Ulmus pumila L.*	Unit	933	1	2	176	757
14	*Caragana arborescens Lam*	Unit	100	2	1	1	99
15	*Larix sibirica Ledeb*	Unit	2	16	8	0	2
16	Vegetation fence	Unit	5048	3	1	0	5048
17	Lawn	Square meter	60256				
Total			**8453**			**1074**	**7379**

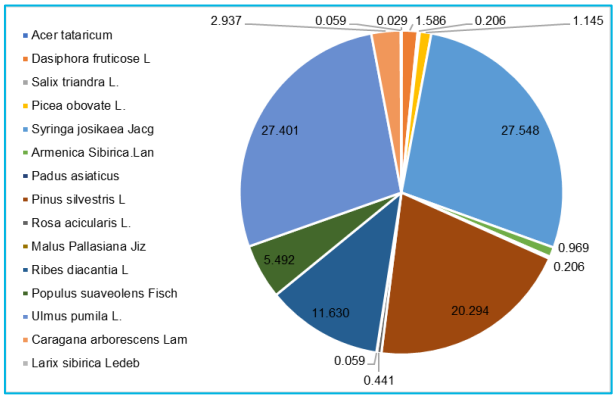

Figure 4-46 Number of trees in green space

As part of the road expansion and reconstruction activities under the “Ulaanbaatar Light Rail Transit (LRT) from the General Archives to Sukhbaatar Square” project, Line LRT-II, the trees and shrubs growing are managed by the respective district authorities, while their daily maintenance is contracted out to specialized organizations.

The number of trees suitable for transplantation within the project site has been identified. The costs associated with transplantation have been calculated and budgeted within the project.

Transplantation locations should be coordinated with the respective district authorities, and the transplantation activities must be carried out by specialized organizations.

As shown in Figure 4-47, As shown in Figure 2-45, out of the total 8,453 trees, 1,074 trees (12.71%) are considered feasible for transplantation, while 7,379 trees (87.29%) are considered not feasible for transplantation. In certain locations within the project implementation area, some trees and shrubs have been planted for many years, with certain specimens being 50 to 60 years old. These plants have reached full maturity, their root systems are fully developed and aged, and therefore, they were assessed as impossible to resettlement due to limited possible to resettlement.

Newly planted and young trees are possible to resettlement.

After project completion, there will be no available space in these locations for re-establishing green areas. For trees that cannot be transplanted, compensation for damages should be paid, or alternatively, in coordination with the responsible district authorities, new green spaces can be created in other locations to carry out replanting and restoration.

Figure 4-47 Percentage of possible and impossible to resettlement trees In green space

Therefore, within the scope of the detailed environmental impact assessment, it is necessary to conduct an ecological and economic valuation of the green spaces affected by the "Ulaanbaatar Tram Project" along the alignment from the General Archives Authority to Sukhbaatar Square.

4.14 Fauna

The Tuul River Basin belongs to the Northern Zone, Taiga Province, and the Khen Khentii and Mongol Dagiir Steppe, according to the Mammals Zoogeographical regions of Mongolia[107], [108] (Bannikov, 1954). Most of Ulaanbaatar's territory falls within the Khentii Region. The Khentii Region covers an area of 7,227,931.85 hectares, of which 27% is designated as Special Protected Areas. Mammals Zoogeographical regions of Mongolia as shown in Figure 4-48.

In this region, the composition of forest pest insects includes 7 orders and 114 species. Among mammals, the area is home to 5 insectivores, 4 bat species, 4 lagomorphs, 19 rodents, 13 carnivores, 5 ungulates, 1 reptile species, and 322 bird species. According to researchers (Mendbaatar & Amgalanbaatar, 1999), this accounts for approximately 40% of Mongolia's total fauna. Notable species among these include: Mesechinus dauuricus, Daurian pika, Mongolian

[107] Bannikov, 1954
[108] Tsegmid, 1969

Marmota, Phodopus campbelli, Allactaga sibirica, Alticola semicanus, Lepus tolai, Capreolus pygargus, Cervus elaphus, Sus scrofa, Mustela nivalis, Mustela eversmanni, Vulpes corsac, Vulpes vulpes, Canis lupus and Otocolobus manul.

A field survey of the fauna was conducted in the vicinity of the project area as part of the Selbe Sergelt[109] Project. The survey route is shown in Figure 4-48. According to previous studies[110], a total of 27 species of vertebrates may be present within Ulaanbaatar city, including 24 bird species and 3 mammal species.

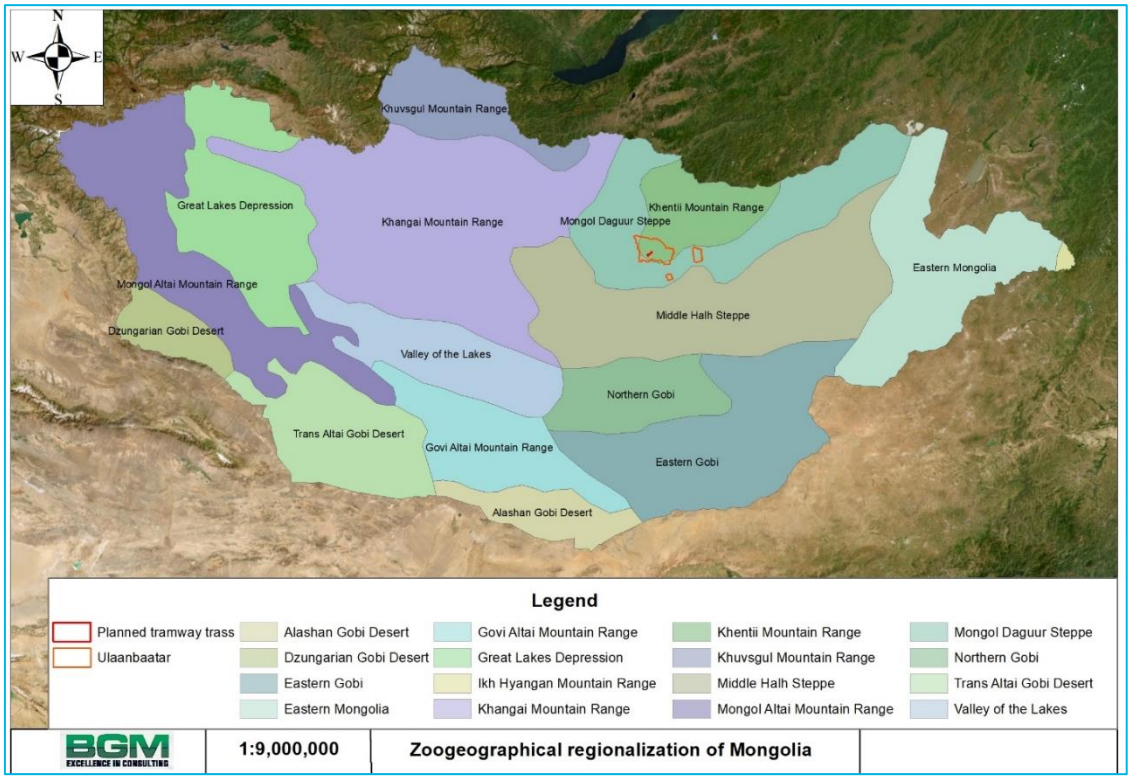

Figure 4-48 Zoogeographical regionalization of Mongolia (Bannikov, 1954), Khentii Mountain range

Bird: Scientists and researchers have continuously documented the species composition of birds inhabiting Ulaanbaatar and the surrounding mountains. In 1997, Sh. Boldbaatar recorded a total of 204 bird species belonging to 14 orders, 40 families, and 110 genera. In 1977 and 2005, A. Bold and N. Tseveenmyadag documented 216 species within 16 orders, 38 families, and 113 genera. In 2008, S. Gombobaatar noted 188 species across 14 orders, 35 families, and 101 genera in his reports and publications. Subsequently, in 2011, as part of the "Green Space Biodiversity Status" project, 82 species of birds were recorded, classified under 12 orders, 27 families, and 55 genera. In addition, researchers from the Mongolian Birdwatching Club have been conducting regular bird observations. Their monitoring locations include the area surrounding Biocombinat and the Tuul River, along the railway at the base of Songino Khairkhan Mountain, and the lake near the wastewater treatment facility southwest of Thermal Power Plant No. 4. On May 19, 2013, their survey recorded 53 species, and on April 13, 2014, they documented 33 species of birds.

The possible bird species composition has been categorized by order and is presented in Figure 4-49.

[109] BGM Distribution LLC, 2023. Detailed Environmental Impact Assessment for the Selbe Sergelt Project.
[110] BGM Distribution LLC, 2023. Detailed Environmental Impact Assessment for the Selbe Sergelt Project.

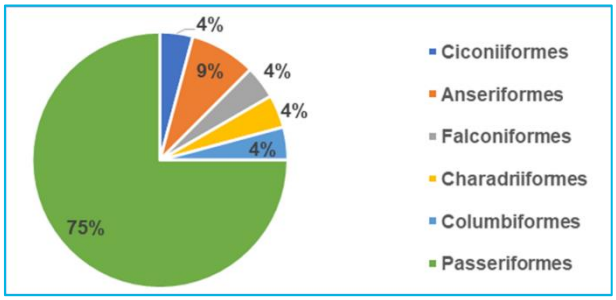

Figure 4-49 Proportions of Occasions by Species Occurrence Form

The International Union for Conservation of Nature (IUCN) classifies species based on specific criteria into conservation status categories such as "Extinct," "Critically Endangered," "Vulnerable," and "Near Threatened". Therefore, the conservation status of the 24 bird species recorded around the Selbe River is shown Table 4-28 according to their listings in the Red List.

Table 4-28 List of Birds Observed

#	Scientific name	Mongolian name	Conservation status	
			Regional status	IUCN status
	***Ciconiiformes* - Оровлигтоны баг**			
	***Ardeidae* - Дэглийхэний овог**			
1	*Egretta alba*	Цасч дэглий	LC	LC
	***Anseriformes* - Галуутаны баг**			
	***Anatidae* - Нугасныханы овог**			
2	*Tadorna ferrugenia*	Ангир, Хондон ангир	LC	LC
3	*Anus plathyrhynchos*	Зэрлэг нугас	LC	LC
	***Falconiformes* - Шонхортоны баг**			
	***Accipitridae* - Харцгайнханы овог**			
4	*Milvus migrans*	Сохор элээ	NA	LC
	***Falconidae* - Шонхорынхоны овог**			
5	*Falco sp.*	Шонхор	LC	LC
	***Charadriiformes* - Хөгчүүтэний баг**			
	***Laridae* - Цахлайтны овог**			
6	*Sterna hirundo*	Эгэл хараалай	LC	LC
	***Columbiformes* - Тагтааны баг**			
	***Columbidae* - Тагтааныханы овог**			
7	*Columba livia*	Хөхвөр тагтаа	LC	LC
	***Passeriformes* - Бор шувуутаны баг**			
	***Hirundidae* - Хараацайнханы овог**			
8	*Delichon urbica*	Хүрээний хараацай	LC	LC
	***Motacillidae* - Харагчныханы овог**			
9	*Anthus richardi*	Хээрийн шийхнүүхэй	LC	LC
	***Motacillidae* - Харагчныханы овог**			
10	*Motacilla cinerea*	Уулын цэгцгий	LC	LC
11	*Motacilla alba*	Хөх цэгцгий	LC	LC
	***Corvidae* - Хэрээнийхэний овог**			
12	*Pica pica*	Шаазгай	LC	LC
13	*Pyrrhocorax pyrrhocorax*	Улаан хошуут (Жунгаа)	LC	LC
14	*Corvus corone*	Хар хэрээ	LC	LC
15	*Corvus corax*	Хон хэрээ	LC	LC
	***Turdidae* - Хөөндийхэний овог**			
16	*Saxicola torquata*	Эгэл шулганаа	LC	LC
17	*Oenanthe oenanthe*	Адууч чогчоохой	LC	LC
18	*Oenanthe isabellina*	Бүжимч чогчоохой	LC	LC
19	*Phoenicurus auroreus*	Дагуур галсүүлт	LC	LC
	***Paradidae* - Хөх бухынханы овог**			
20	*Parus major*	Их хөх бух	LC	LC
	***Ploceidae* - Бор шувууныханы овог**			

#	Scientific name	Mongolian name	Conservation status	
			Regional status	IUCN status
21	*Passer domesticus*	Оронгийн бор шувуу	LC	LC
22	*Passer montanus*	Хээрийн бор шувуу	LC	LC
	***Fringillidae* - Бужирганыханы овог**			
23	*Uragus sibiricus*	Үүрэн сүүлт зана	LC	LC
	***Emberizidae* - Хөмрөгийнхөний овог**			
24	*Emberiza sp.*	Хөмрөг	LC	LC
Тайлбар: Үнэлэх боломжгүй (NA), Анхааралд өртөхгүй (LC)				

The Great Egret is listed in the "Red List" of Mongolia and has been included in the "List of Rare" approved by Government Resolution No. 264 of 2001. Among the recorded bird species, one species the Milvus Migrans is listed in Appendix II of the CITES Convention (SeeTable 4-29).

Table 4-29 Conservation status of Bird species

#	Scientific name	Mongolian name	Conservation status						
			Asian Red List	Mongolian Red List	CR	LC	CTIS-I	CTIS-II	CMS-Annex I
	***Ciconiiformes* - Оровлигтоны баг**								
	***Ardeidae* - Дэглийхэний овог**								
1	*Egretta alba*	Цасч дэглий		+		+			
	***Falconiformes* - Шонхортоны баг**								
	***Accipitridae* - Харцгайнханы овог**								
2	*Milvus migrans*	Сохор элээ						+	

Mammals: Since the project area is located in Ulaanbaatar city, a conclusion of the status of mammal species is provided based on the results of the “Environmental baseline of the Capital City” (2011) report.

In the forest and forest-steppe zones surrounding Ulaanbaatar city, researchers had previously recorded a total of 51 species of mammals belonging to 6 genus. However, in recent years, some of these species have disappeared due to the impacts of urbanization and human settlement. Such as, More than 10 species of animals, including the Cervus elaphus, Capreolus pygargus, Sus scrofa, Moschus moschiferus, Ursus arctos, Gulo gulo, Mustela sibirica, and Martes zibellina, have migrated away or disappeared due to urban expansion and human disturbance.

As of 2011, researchers have identified the distribute of 41 species of mammals belonging to 5 genus in around the Ulaanbaatar city. The number of mammal species recorded around Ulaanbaatar in 2011 is as shown in Table 4-30.

Table 4-30 Number of mammals species recorded in 2011, in around Ulaanbaatar

№	Scientific name of Family	Mongolian name of Family	Number of species	Percentage
1	Inserctivora	Шавж идэштэн	5	12.2
2	Chiroptera	Гар далавчтан	6	14.6
3	Lagomorpha	Туулай хэлбэртэн	4	9.8
4	Rodentia	Мэрэгчтэн	18	43.9
5	Carnivora	Махан идэштэн	8	19.5
6	Artiodactyla	Туруутан	-	-
	Total		**41**	**100**

In the project area, due to factors such as anthropogenic impacts, overpopulation, vehicular traffic, industrial activities, and livestock grazing, the habitat of mammals has significantly deteriorated and changed, leading to the contraction of their distribution range. As a result, mammal species have largely disappeared from the area.

Based on the surface features of the land surrounding the project site, the potential composition of mammal species in the corridor areas was assessed. It is estimated that 3 mammal species belonging to 2 orders may be present (seeTable 4-31).

Table 4-31 Composition of Mammal species

№	Scientific name	English name	Location
	***Lagomorpha* - Туулайтаны баг**		
	***Leporidae* - Туулайнхан овог**		
1	*Lepus tolai*	Боролзой туулай	Potentially present in the Selbe-Tuul river confluence area
	***Rodentia* - Мэрэгчтэний баг**		
	***Muridae* - Хулганыхан овог**		
2	*Mus musculus*	Гэрийн хулгана	Present in round the settlement and ger area
	***Dipodidae* - Алагдаагынхан овог**		
3	*Allactaga sibirica*	Шивэр алагдаага	Potentially present in the meadow steppe or, around from 6 buudal to bridge of 17

The composition of mammals species is shown in Table 4-32, indicating their conservation status according to the Mongolian Red List of Mammals.

Table 4-32 Mammal species in urban area of Ulaanbaatar with their conservation status

№	Scientific name	English name	Conservation status			
			Mongolian Red List	Mongolian Red List of Mammals		CITES-I, Annex-II
				Regional status	IUCN Red List	
	***Lagomorpha* - Туулайтаны баг**					
	***Leporidae* - Туулайнхан овог**					
1	*Lepus tolai*	Боролзой туулай		LC	NA	
	***Rodentia* - Мэрэгчтэний баг**					
	***Muridae* - Хулганыхан овог**					
2	*Mus musculus*	Гэрийн хулгана	-	NA	NA	
	***Dipodidae* - Алагдаагынхан овог**					
3	*Allactaga sibirica*	Шивэр алагдаага	-	LC	LC	
Тайлбар: Үнэлэх боломжгүй (NA), Анхааралд өртөхгүй (LC) Description:						

None of these species have been recorded as rare or endangered in the Mongolian Red Book (1987), nor are they listed in Appendices I or II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

4.15 Special protected area

“Ulaanbaatar Public Transport (Light Rail Transit-LRT) from General Archives to Sukhbaatar Square” project planned to encompass the territories of Sukhbaatar and Khan-Uul districts. The Bogd Khan Mountain national conservation park is the state protected area located closest to Ulaanbaatar city. The information of special protected area is shown in Table 4-33 and location of of special protected area is shown in Figure 4-50.

Table 4-33 Locations of Protected Area around

Name of SPA	Type of SPA	Area, ha	Distance from project site
Bogdkhan Mountain	national conservation park[111]	42271.24	Minimum 2 km

The project site overlaps with the limited zone of Bogd Khan Mountain national conservation park. However, according to Article 12.1 of the Law on Specially Protected Areas, "change the state of the nature by land ploughing, digging or exploding, minerals exploring, mining, sand or pit gravel procuring, wood, reed cutting, and road making in area other limited zone". Therefore, implementing this project within the limited zone is not legally prohibited[112].

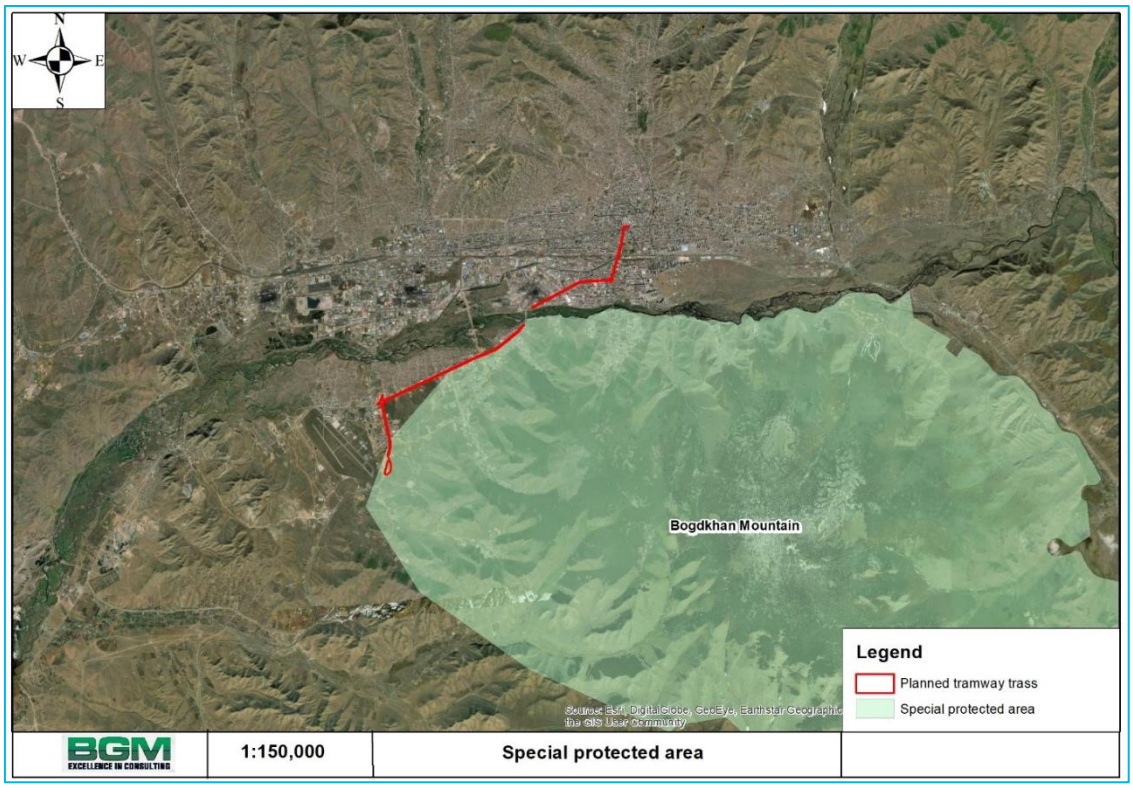

Figure 4-50 Special protected area

"Bogdkhan Mountain" national conservation park

Table 4-34 Information of Special Protected Area

Name	Bogdkhan Mountain
Designation date	1957.03.13
Designated resolutions and resolution number	By Resolution No. 26 of the Governent (Parliament) in 1995
Administration	It is located in the territories of Khan-Uul and Bayanzurkh Districts of Ulaanbaatar city, and Sergelen soum of Tuv Province.
Area, ha	42192.36

Bogd Khan Mountain is recognized as a site of national and global importance for maintaining ecological balance, with significant natural, historical, cultural, and scientific value. It was registered in UNESCO's Man and the Biosphere (MAB) Reserve Network in 1996 and was officially certified in 1997.

[111] https://legalinfo.mn/mn/detail/479
[112] https://legalinfo.mn/mn/detail/479

The area of The Bogd Khan national conservation park covers a total area of 42,271.24 hectares.

- Limited zone: 12035.09 ha
- Protected zone: 23314.48 ha
- Virginal zone: 6921.66 ha

The Bogd Khan national conservation park is located near Ulaanbaatar, where nearly 50% of Mongolia's population resides. It lies just 4–5 km from the city center and is part of the southwestern branch of the Khentii mountain range. The area stretches approximately 31 km from west to east and 20 km from north to south, generally extending in an east-west direction. It is situated between latitudes 47°54′N and longitudes 106°46′E to 107°10′E[113].

4.16 Historical and Cultural Heritage

Article 7 of Chapter 1 of the "The Constitution of Mongolia" states that "The historical and cultural memorials, as well as scientific and intellectual heritage of the Mongolian people shall be under State protection[114]," and Article 5, Section 27.8 of the "Law on the Protection of Cultural Heritage of Mongolia" states that "Preliminary prospecting and research shall be carried out and the assessment thereto shall be issued by professional paleontological, archaeological or ethnological scientific organizations for the assessment, prior to issuing land for purposes of economic activity associated with settlement, construction, paving new roads, establishing hydro power plants, conducting crop farming, mine prospecting and exploitation"[115]. The project area is located within a residential area, specifically in Ulaanbaatar city, and the planned project alignment largely overlaps with areas previously studied[116]. According to earlier studies, no archaeological or paleontological findings have been discovered. However, within the scope of the general environmental assessment conclusion, a preliminary exploration study must be conducted, and if necessary, an official evaluation should be obtained from a professional institution.

4.17 Socio-economic Baseline Conditions

The area of influence (AoI) of the "Ulaanbaatar Public Transport (Light Rail Transit-LRT) from General Archives to Sukhbaatar Square" project planned to encompass the territories of 15 khoroos of Sukhbaatar and Khan-Uul districts. The information of khoroos included in the AoI are shown in Table 4-35 and Figure 4-51.

Table 4-35 Project implementation area

№	District	Khoroo
1	Sukhbaatar	1st khoroo
2	Khan-Uul	1, 2, 3, 4, 5, 6, 7, 8, 15, 16, 18, 19, 20, 21st khoroo

Ulaanbaatar city has 204 khoroos of 9 districts. Capital city covers a total area of 4700 square.km, with a population density of 360 people per square kilometer[117]. The project implementation area includes 15 khoroos of 2 districts. The socio-economic baseline study of the khoroos of AoI was developed based on the reports and data of the National Statistics Office, as well as socio-economic information from the khoroos and other available data sources.

[113] http://bogdkhan.mpa.gov.mn/sub/15/67
[114] https://legalinfo.mn/mn/detail?lawId=367
[115] https://legalinfo.mn/mn/detail/10439
[116] BGM, 2023. Detailed Environmental and Social Impact Assessment of the "Selbe sergelt" project.
[117] National Statistic Office. https://www.1212.mn/mn

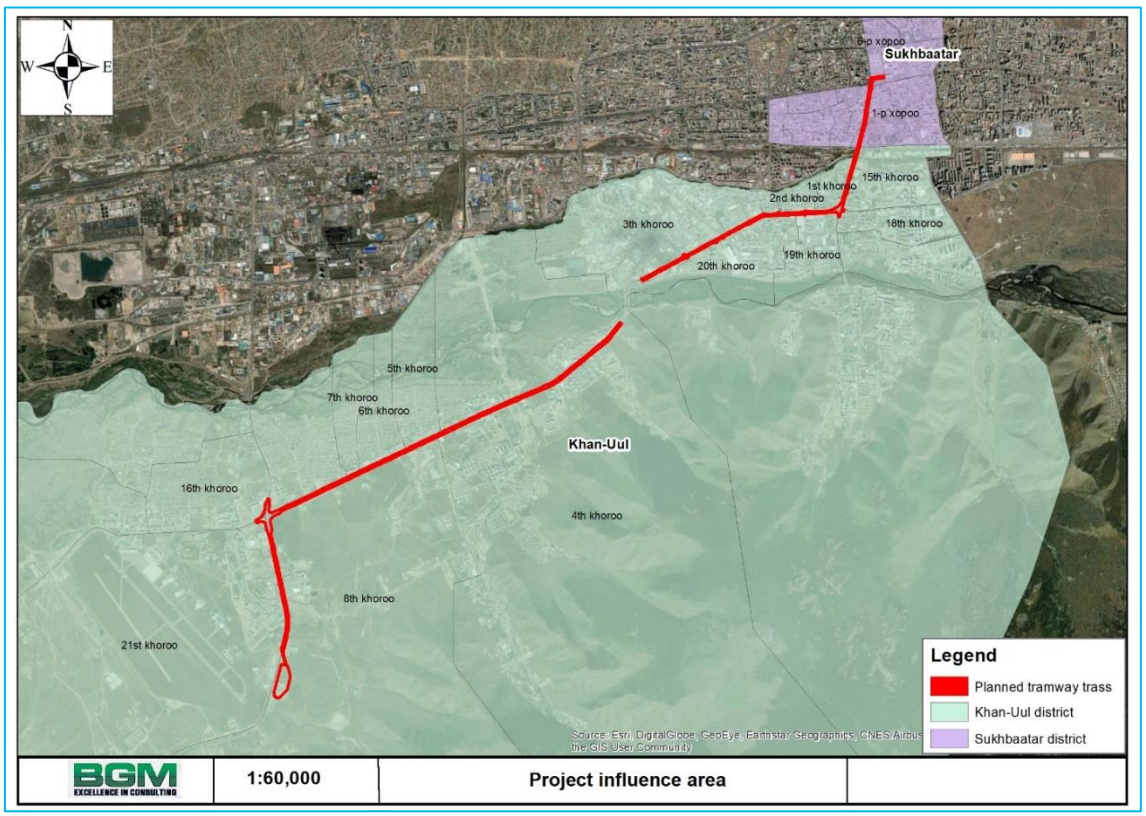

Figure 4-51 District and khoroo affected by project

4.17.1 Population and demographic profile

<u>Information of population and household</u>

Ulaanbaatar city.

As shown in Figure 4-52, The resident population in Ulaanbaatar city in 2023 was 1,640,781 people across 465,059 households. This represents an increase of 2.7% or 44,446 people compared to the same period of the previous year. 51.6% of total population (847,345) are female, 48.4% (793,436) are male in 2023[118].

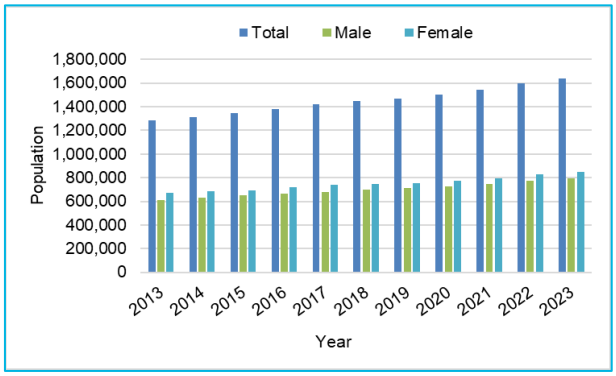

Figure 4-52 Population of Ulaanbaatar, 2013-2023

[118] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/573051/table-view/DT_NSO_0300_033V1

"Ulaanbaatar Public Transport (Light Rail Transit-LRT) from General Archives to Sukhbaatar Square" project planned to encompass the territories of Sukhbaatar and Khan-Uul districts. Population of the project site districts is shown in Figure 4-53.

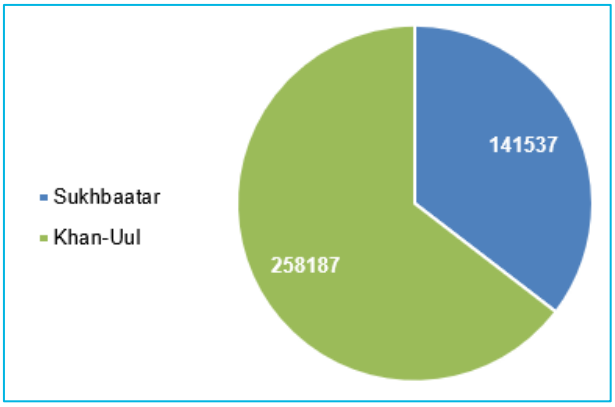

Figure 4-53 Population of project site districts, 2023

Sukhbaatar district. In 2022, there were 38,782 households with a total population of 142,444. By 2023, the number of households increased to 39,984, while the population decreased to 141,537 decreaced by 907 people. 53.9% of the total population are between the ages of 15-54 or labour-aged, 30.9% are 0-14 aged children, and 15.2% are above 55 years old[119]. Population change of Sukhbaatar district in the last 10 years is shown in Figure 4-54.

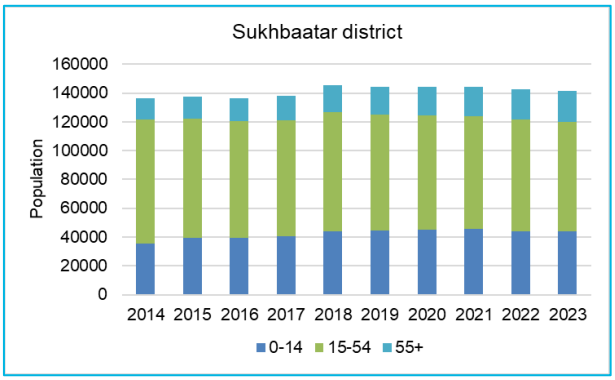

Figure 4-54 Population of Sukhbaatar district, by age group, 2014-2023

The number of households in Sukhbaatar district and project khoroo are shown in Table 4-36.

Table 4-36 Household numbers of Sukhbaatar district, 2020-2023

	2020	2021	2022	2023
Sukhbaatar district	39507	39302	38782	39984
1st khoroo	2547	2516	2490	2476

The population density or the number of people per unit area is in Sukhbaatar District ranged between 654.6 and 694 people per km² during the period from 2014 to 2023. This indicates that 694 people live per square kilometer, reflecting a high population density[120] (See Figure 4-55).

[119] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/573051/table-view/DT_NSO_0300_067V2
[120] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/573051/table-view/DT_NSO_0300_004V5

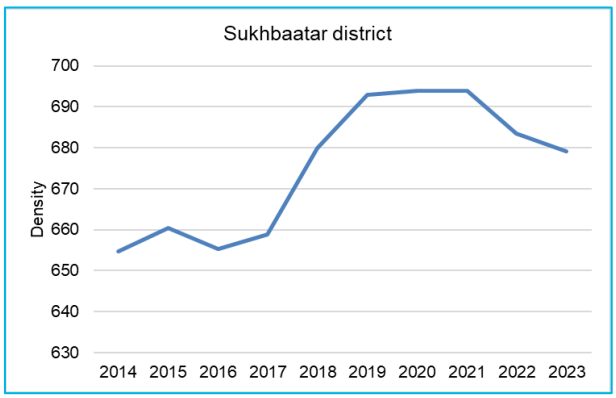

Figure 4-55 Population density of Sukhbaatar district

Number of population by age group in 1, 5, 6, 8, 9, 10, 11, 12, 13 and 14th khoroo of Sukhbaatar district is shown in Figure 4-56. 1, 10 and 11th khoroo are the most residents. As of 2023, 1st khoroo had 2476 households and 9414 residents, 5th khoroo had 1412 households and 4865 residents, 6th khoroo had 1524 households and 5192 residents, 8th khoroo had 1831 households and 7043 residents, 9th khoroo has 2501 household and 9076 residents, 10th khoroo had 2335 households and 9410 residents, 11th khoroo and 4662 households and 16733 residents, 12th khoroo had 1541 households and 5648 residents, 13th khoroo had 2042 households and 7419 residents, 14th khoroo had 1300 households and 4496 residents[121].

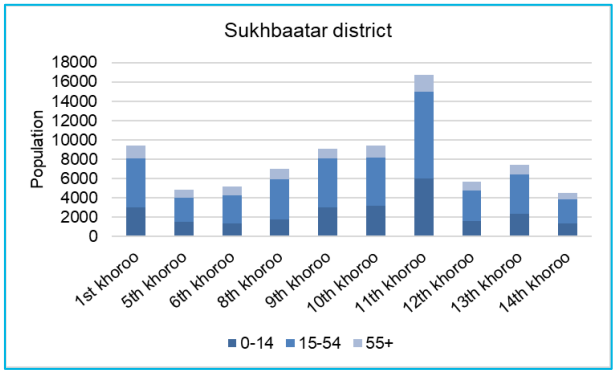

Figure 4-56 Population of Sukhbaatar district, by age group, by khoroo, 2023

As of 2023, the sex ratio[122] of the total population in Sukhbaatar district was 93.6 males per 100 females. This reflects a higher number of females compared to males within the district.

Khan-Uul district. In 2022, there were 63,967 households with a total population of 238,511. By 2023, the number of households increased to 72,900, while the population decreased to 258,187 decreaced by 19,676 people. 52.7% of the total population are between the ages of 15-54 or labour-aged, 35.3 % are 0-14 aged children, and 11.8% are above 55 years old[123]. Population change of Khan-Uul district in the last 10 years is shown in Figure 4-57.

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Figure 4-57 Population of Khan-Uul district, by age group, 2014-2023

The number of households in Khan-Uul district and project khoroo are shown in Table 4-37.

[121] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/573051/table-view/DT_NSO_0300_006V5
[122] Sex ratio: ratio of the male population to the female population.
[123] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/573051/table-view/DT_NSO_0300_067V2

Table 4-37 Household numbers of Khan-Uul district, 2020-2023

	2020	2021	2022	2023
Khan-Uul district	52769	56874	63967	72900
1st khoroo	2411	2456	2452	2448
2nd khoroo	2865	3061	3157	3250
3th khoroo	3236	3488	3956	4307
4th khoroo	4443	5018	1660	1752
5th khoroo	1337	1344	1321	1339
6th khoroo	1735	1924	2064	2134
7th khoroo	1342	1311	1328	1353
8th khoroo	2811	2910	3020	3092
15th khoroo	3784	4159	4892	6164
16th khoroo	3801	4054	2270	2381
18th khoroo	1707	2389	3042	3829
19th khoroo	2978	2932	4242	4332
20th khoroo	2725	2676	2570	3083
21st khoroo	1725	2389	2830	3557

The population density or the number of people per unit area is in Khan-Uul district ranged between 285.5 and 532.7 people per km² during the period from 2014 to 2023. This indicates that 532.7 people live per square kilometer, reflecting a high population density[124] (SeeFigure 4-58).

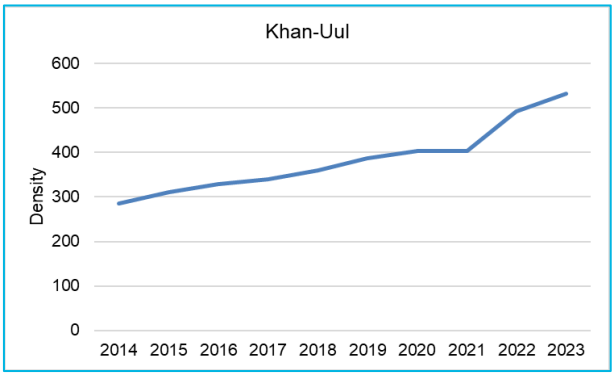

Figure 4-58 Population density of Khan-Uul district

Number of population by age group in 1, 2, 3, 4, 5, 6, 7, 8, 15, 16, 18, 19, 20 and 21st khoroo of Khan-Uul district is shown in Figure 4-59. 3, 15, 19 and 24th khoroo are the most residents. As of 2023, 1st khoroo had 2448 households and 10,516 residents, 2th khoroo had 3250 households and 12,794 residents, 3th khoroo had 4307 households and 15,452 residents, 4th khoroo had 1752 households and 6439 residents, 5th khoroo has 1339 household and 4809 residents, 6th khoroo had 2134 households and 6974 residents, 7th khoroo and 1353 households and 4498 residents, 8th khoroo had 3092 households and 10,922 residents, 15th khoroo had 6164 households and 19,430 residents, 16th khoroo had 2381 households and 8595 residents, 18th khoroo had 3829 households and 13,766 residents, 19th khoroo had 4332 households and 15,826 residents, 20th khoroo had 3083 households and 10,648 residents, 21st khoroo had 3557 households and 13,177 residents[125].

[124] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/573051/table-view/DT_NSO_0300_034V2
[125] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/573051/table-view/DT_NSO_0300_006V5

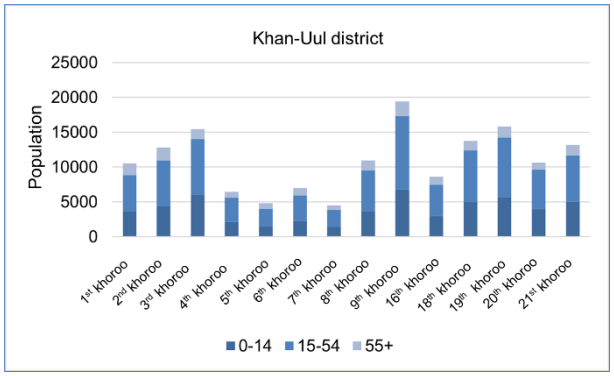

Figure 4-59 Population of Khan-Uul district, by age group, by khoroo, 2023

4.17.2 Labour

Employment[126] of Ulaanbaatar city by classification of economic activities is shown in Figure 4-60. As of 2023, a total of employmets are 562,364 in capital city, of which 54.9% (308,841) are men. Of the total employed population, 111,814 individuals (19.9%) are the large proportion are engaged in wholesale and retail trade, and the repair of motor vehicles and motorcycles[127].

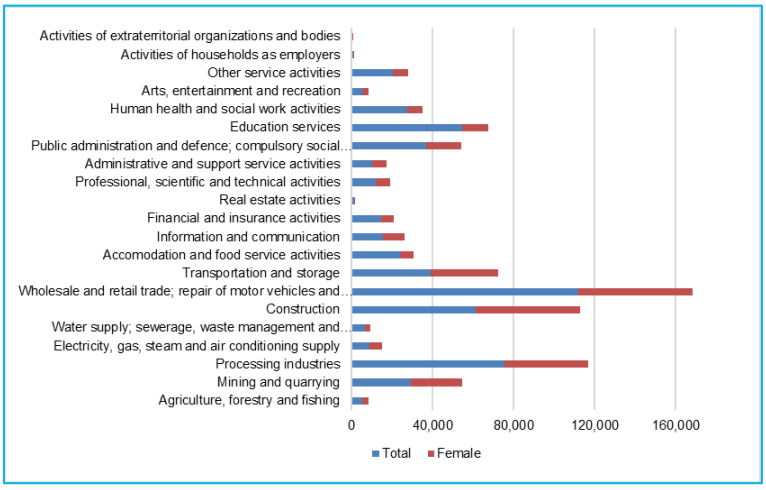

Figure 4-60 Employment, by classification of economic activities, Ulaanbaatar, 2023

As of 2023, labour forces[128] of Ulaanbaatar city is 591,729. Of which 44.4% (263,008) are female. The number of labour force of Sukhbaatar, Khan-Uul and Chingeltei districts implementing "Ulaanbaatar Public Transport (Light Rail Transit-LRT) from General Archives to Sukhbaatar Square" project is shown in Table 4-38. In terms of labour force, Khan-Uul district records the highest figure[129].

Table 4-38 Labour force, as a percentage of the population, %

District	Population	Labour force	%
Sukhbaatar	141,537	57,054	40
Khan-Uul	258,187	88,924	34

[126]Persons in employment are defined as all those of working age who, during a short reference period, were engaged in any activity to produce goods or provide services for pay or profit. Persons in employment are categorized into (a) "at work" and (b) "not at work".
[127] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/573055/table-view/DT_NSO_0400_035V7
[128] Labour force is defined as "the current supply of labour for the production of goods and services in exchange for pay or profit"; either as employed, or as unemployed persons. Labour force = Employment + Unemployed
[129] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/573055/table-view/DT_NSO_0400_012V1

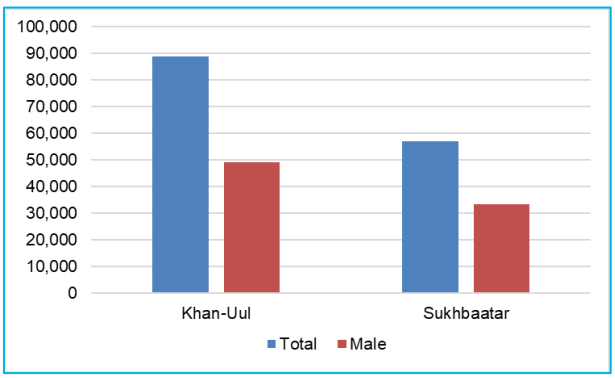

Figure 4-61 Labour force of project site districts

At the national level, the unemployment rate in 2022 was 5.3%. By gender, the unemployment rate was 6.0% for males and 4.5% for females[130]. In the capital city Ulaanbaatar, the unemployment rate was 5% as of 2023[131].

As of 2023, the composite level of labour underutilization in Ulaanbaatar city is 6.0% in Sukhbaatar district and 9.2% in Khan-Uul district. The unemployment rate is 4.3% in Sukhbaatar district (of which 3.3% is female), 3.5% is Khan-Uul district (of which 3.6% is female). See Figure 4-62[132].

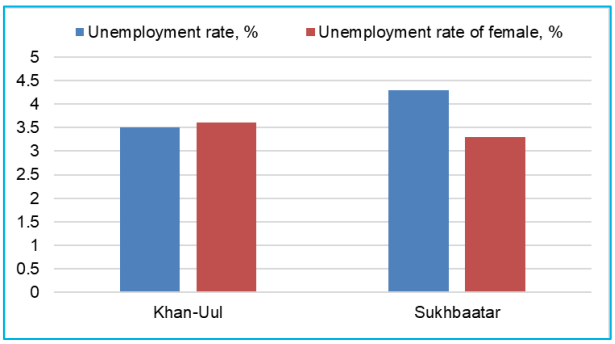

Figure 4-62 Unemployment rate of project site districts

In Ulaanbaatar city in 2024, 86% of the registered unemployed population falls within the 25–55 age group. Also, 55.4% are female of the total unemployed population. (See Table 4-39)[133].

Table 4-39 Registered unemployed population of Ulaanbaatar, by age group

Age group	Total	Of which, female
Total	1752	781
15-24	136	62
25-34	566	257
35-44	597	267
45-54	348	162
55-59	68	22
60+	37	11

[130] Summery of the 2022 First Quarter Labour Force Survey. National Statistic Office. Ulaanbaatar, 2022.
[131] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/573055/table-view/DT_NSO_0400_020V2
[132] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/573055/table-view/DT_NSO_0400_020V2
[133] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/573055/table-view/DT_NSO_0400_002V4

Source: Mongolian Statistical Information Service

Agriculture. As of 2024, there was 53 farmer enterorises and 1,566 farmer households in Ulaanbaatar. See Table 4-40.

Table 4-40 Agriculture

	2024
Number of farmer enterprises	53
Number of farmer households	1,566

As of 2024, the total sown area in Ulaanbaatar city was 1421.9 hectares. Of this, 477.9 hectares were sown areas of enterprises and 1715.3 hectares were sown areas of households. Also, 139703.1 tons were the total harvest. Of which 7091.5 tons were croped of enterprises and 132612.2 tons were croped of households[134]. The total sown areas and the total harvest of Ulaanbaatar in the last 10 years (2010-2024) are shown in Table 4-41.

Table 4-41 Total agriculture of Ulaanbaatar, 2014-2024

Year	Sown area, ha	Sown areas of enterprises, ha	Sown areas of household, ha	Total harvest, tn	Crops of enterprises, tn	Crops of household, tn
2014	1406.2	878.1	1195.3	34711.5	13695.2	21016.6
2015	1522.0	729.6	1297.5	33236.1	8359.7	24876.5
2016	1259.0	317.9	1506.3	37789.1	7266.8	56192.0
2017	1076.1	680.0	712.7	43172.5	5991.5	16166.1
2018	1051.3	774.4	677.1	53917.3	13379.8	69996.4
2019	1139.8	426.4	1217.0	53597.6	6496.7	47101.1
2020	1686.7	1614.1	1512.7	82962.4	8160.3	74801.9
2021	1709.6	2851.1	0.0	110376.2	9896.7	98805.5
2022	2152.6	1988.8	1540.8	98213.7	6719.5	91493.4
2023	2358.9	2382.2	1627.9	138453.3	24991.5	113461.6
2024	1421.9	477.9	1715.3	139703.1	7091.5	132612.2

Source: Mongolian Statistical Information Service

[134]National Statistic Office. https://www.1212.mn/mn/search/%D0%B3%D0%B0%D0%B7%D0%B0%D1%80%20%D1%82%D0%B0%D1%80%D0%B8%D0%B0%D0%BB%D0%B0%D0%BD

4.17.3 Livestock

As of 2024, the number of livestock amounted to 412,790 in Ulaanbaatar city. Livestock data is not available for Sukhbaatar and Chingeltei districts, two of the three districts where the project area. The number of livestock[135] in Khan-Uul district is shown in Figure 4-63.

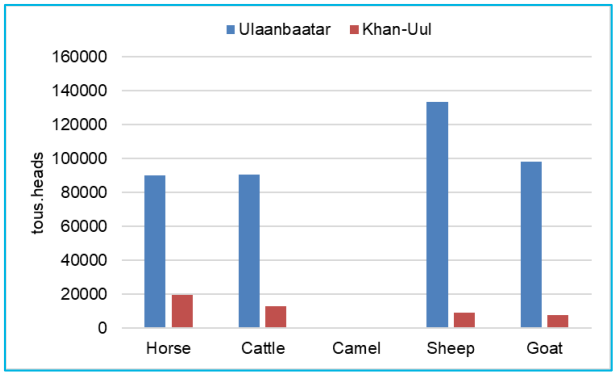

Figure 4-63 Number of livestock, 2024

Compared to the previous year, the number of livestock in Ulaanbaatar city changed as follows: horses increased by 11,680 head, cattle by 3,830 head, and camels by 40 head, while sheep decreased by 22,240 head and goats by 7,690 head. Camels account for 0.01 percent of the total herd, horses for 22 percent, cattle for 22 percent, sheep for 32 percent, and goats for 24 percent[136].

4.17.4 Industry

The production of major commodities include electricity, thermal energy, animal intestines, sausages, liquid milk, pastries, bread, dumplings, vodka, beer, carbonated water, mineral water, beverages, juices, wool, cashmere, carpets, felt, and knitted goods. Among these, the leading industries are manufacturing, food production, alcoholic beverage production, and the generation of electricity and thermal energy[137] (See Table 4-42).

Table 4-42 Industrial indicators of Ulaanbaatar, 2020-2024

Year	Total sold production, million.MNT	Output of agriculture products	Legal entity engaged in small and medium-sized enterprises (SMEs) and services
2020	12,475,915.8	23425.3	37,995
2021	15,758,662.4	23776.9	41,149
2022	15,574,399.5	24581.3	50,238
2023	20,485,594.2	20786.6	55,588
2024	22,990,786.4		

Source: Mongolian Statistical Information Service

As of 2024, the total sales of industrial production sector in Ulaanbaatar city amounted to 22,990,786.3 MNT[138]. See more Figure 4-64.

[135] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/573054/table-view/DT_NSO_1001_021V1
[136] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/573054/table-view/DT_NSO_1001_021V1
[137] National Statistic Office https://www.1212.mn/mn/search/%D0%B0%D0%B6%20%D2%AF%D0%B9%D0%BB%D0%B4%D0%B2%D1%8D%D1%80
[138] National Statistic Office. http://www2.1212.mn/Stat.aspx?LIST_ID=976_L11&type=tables

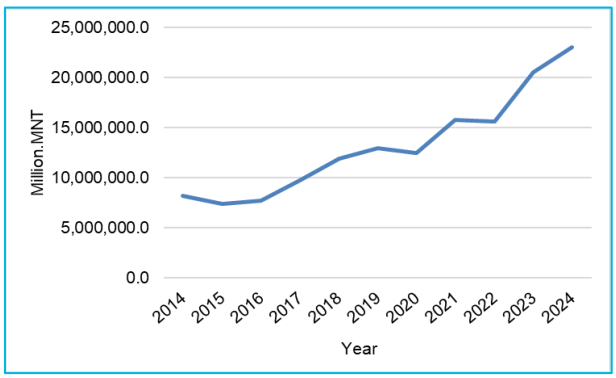

Figure 4-64 Sales of industrial production in Ulaanbaatar, 2014-2024

4.17.5 Education

In 2010, 96.1% of all six year old children in Ulaanbaatar were enrolled in school, but by 2020 this rate had declined to 90.8%, a decrease of 5.3 percentage points. Among eight year old children, school enrollment was highest in 2010 at 98.8%, but slightly declined to 98.4% in 2020 (a drop of 0.4 percentage points). In contrast, the enrollment rate of ten year olds increased from 98.4% in 2010 to 99.1% in 2020.

School enrollment remained consistently high up to age 14, after which it began to decline gradually, reaching 97.6% by age 17. This corresponds to the typical age when students complete their secondary education.

Compared to the 2010 census, school enrollment increased across all age groups over 10 years old. Notably, enrollment among individuals aged 25–29 rose 2.6 times, which is likely due to an increasing number of young people pursuing master's degrees following their bachelor's studies.

When analyzed by gender, school enrollment among girls was higher than boys in the 6–9 age group, nearly equal in the 10–14 age group, and higher among females for all age groups from 15 and above. This trend suggests that the number of women attaining higher education will likely remain high in the future, potentially continuing through the next population census.

In 2020, a total of 3,513 six-year-old children in the capital city were not enrolled in school, of whom 52.2% were boys and 47.8% were girls[139].

4.17.5.1 General educational school

As of 2024, there are 314 general educational schools in Ulaanbaatar, of which 163 are public schools and 151 are private schools. There were 397,338 students of general educational school, 24,512 total employees and 17,429 full-time teachers in general educational schools of Ulaanbaatar. The information about the total of general educational schools in project implementation districts is shown in Table 4-43[140].

Table 4-43 General educational school information of project implementation districts

	Districts	2019	2020	2021	2022	2023	2024
Full-time students	Sukhbaatar	41,122	43,442	43,969	46,410	48,022	49,580
	Khan-Uul	35,606	40,757	47,715	54,432	61,418	69,364
	Sukhbaatar	46	50	49	52	51	51

[139] National Statistic Office. https://www.1212.mn/mn
[140] National Statistic Office. https://www.1212.mn/mn/search/%D0%95%D0%91%D0%A1

	Districts	2019	2020	2021	2022	2023	2024
Number of general educational schools	Khan-Uul	46	48	46	46	50	49
Full-time teachers	Sukhbaatar	2,058	2,248	2,183	2,269	2,442	2,488
	Khan-Uul	1,196	1,263	1,264	1,279	1,254	1,157
Source: Mongolian Statistical Information Service							

There were 365,118 students in 300 public general educational schools in the Capital city during the 2022-2023 academic year. Of which, 118,944 students (32.5%) studying in 15 khoroos of 2 districts in the project influenced area. See more Table 4-44.

Table 4-44 General education school information of project influenced area

Districts	Number of general educational schools	Full-time teachers	Number of groups	Number of students	Capacity
Sukhbaatar	26	1,207	785	23,016	16,807
Public	15	803	517	16,876	11,332
Private	11	404	268	6,140	5,475
Khan-Uul	14	832	568	20,748	12,829
Public	7	595	419	17,411	8,507
Private	7	237	149	3,337	4,322
Source: Metropolitan Department of Education[141]					

Sukhbaatar district: As of 2024, there were 2488 full-time teachers in 51 general educational schools providers operating in Sukhbaatar district. The number of students enrolled in these schools was 41,122 in 2019, 43,442 in 2020, 43,969 in 2021, 46,410 in 2022, 48,022 in 2023, and 49,580 in 2024 (Figure 4-65)[142].

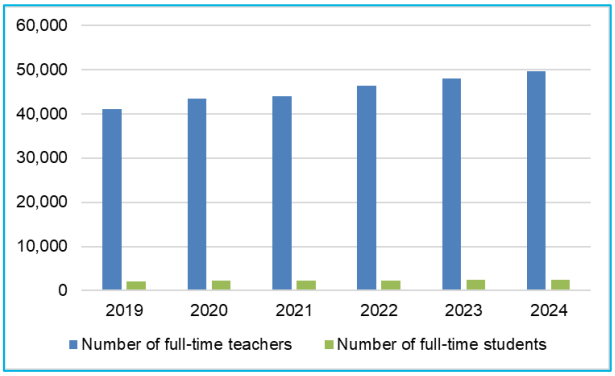

Figure 4-65 Number of teachers and students of General educational school, 2019-2024

Khan-Uul district: As of 2024, there were 3119 full-time teachers in 65 public and private schools providers operating in Khan-Uul district. The number of students enrolled in these schools was 35,606 in 2019, 40,757 in 2020, 47,715 in 2021, 54,432 in 2022, 61,418 in 2023, and 69,364 in 2024 (Figure 4-66)

[141] https://www.city.edu.mn/en/index
[142] National Statistic Office. https://www.1212.mn/mn/search/%D0%95%D0%91%D0%A1

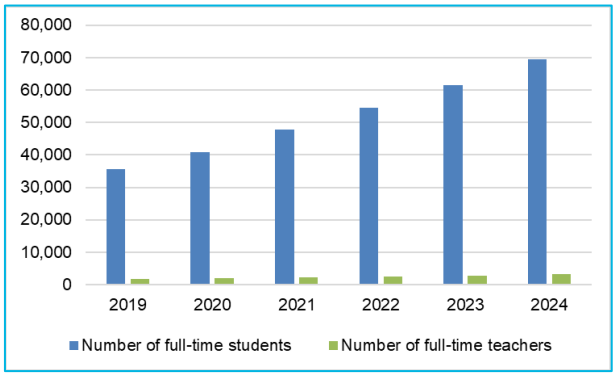

Figure 4-66 Number of teachers and students of General educational school, 2019-2024

4.17.5.2 Pre-school education

As of 2024, there were 125,429 children in 655 kindergarteners in the Capital city. Of which, 36,130 children (28.8%) studying in 15 khoroos of 2 districts in the project area. See Table 4-44[143].

Table 4-45 Pre-school indicators of project implementation districts

District	Pre-school numbers	Number of buildings	Number of groups	Number of children in pre-school	Capacity
Sukhbaatar	28	37	191	5,369	4,092
Public	16	25	150	4,484	3,050
Private	12	12	41	885	1,042
Khan-Uul	42	65	323	8,989	7,886
Public	9	29	178	5,599	4,537
Private	33	36	145	3,390	3,349

Source: Metropolitan Department of Education[144]

Sukhbaatar district: As of 2024, there were 10,063 children enrolled in 57 public and private kindergarten. The number of children enrolled pre-school education in these kindergarten was 11,782 in 2019, 10,487 in 2020, 7,715 in 2021, 11,149 in 2022, 10,808 in 2023, and 10,063 in 2024 (Figure 4-67).

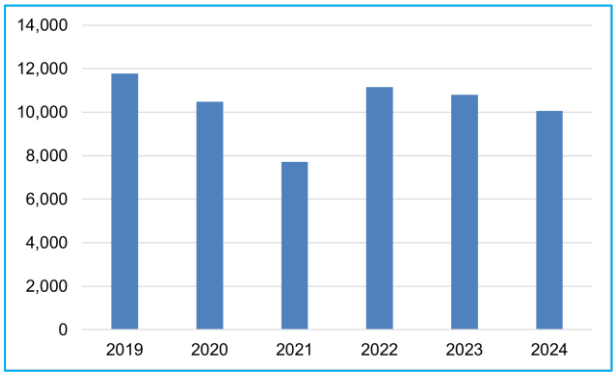

Figure 4-67 Number of children in pre-school institutions, 2019-2024

As of 2024, there were 1482 employees of pre-school institutions in Sukhbaatar district. Of which, 432 are full-time teachers, 377 are assistant teachers and 574 are other employees as shown in Figure 4-68[145].

[143] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/48171313/table-view/DT_NSO_2002_058V4
[144] https://www.city.edu.mn/en/index
[145] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/48171313/table-view/DT_NSO_2002_058V4

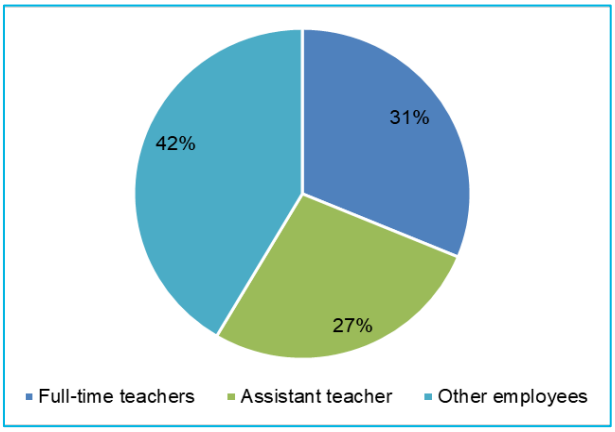

Figure 4-68 Employees of pre-school institutions, 2024

Khan-Uul district: As of 2024, there were 26,067 children enrolled in 134 public and private kindergarten. The number of children enrolled pre-school education in these kindergarten was 18,627 in 2019, 17,465 in 2020, 13,928 in 2021, 23,081 in 2022, 25,195, in 2023, and 26,067 in 2024[146].

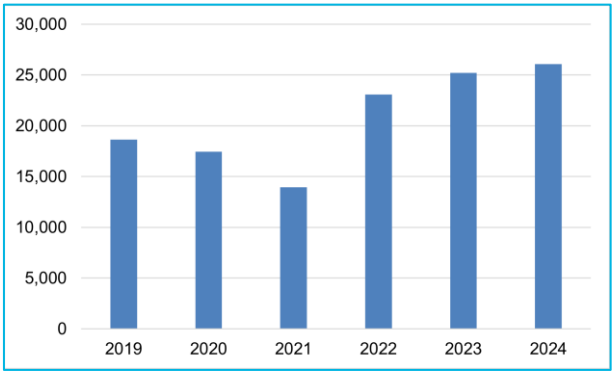

Figure 4-69 Children in pre-school institutions, 2019-2024

As of 2024, there were 2934 employees of pre-school institutions in Khan-Uul district. Of which, 888 are full-time teachers, 833 are assistant teachers and 998 are other employees as shown in Figure 4-70.

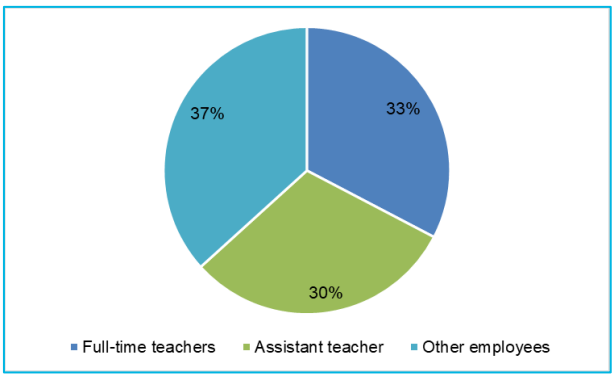

Figure 4-70 Employees of pre-school institutions, 2024

[146] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/48171313/table-view/DT_NSO_2002_058V4

4.17.6 Crime

According to police report, there were over 300 thousand crimes registered in Ulaanbaatar between 2018 and 2023. In 2022, a total of 24,310 crimes were registered in Ulaanbaatar city. In 2023, this number increased to 24,978, representing a 2.7% rise. The number of offenders related registered crimes is 15,614 as shown in Table 4-46[147].

Table 4-46 Crime information of Ulaanbaatar, 2008-2023

Year	Recorded crimes	Number of offenders	Victims of crime
2008	10901	9110	
2009	11339	9966	
2010	10863	9502	10,710
2011	10773	9483	10,564
2012	12910	10529	12,404
2013	15419	12361	15,029
2014	17205	13315	16,906
2015	17939	14511	17,550
2016	17909	14482	18,005
2017	21947	9618	26,579
2018	25652	8844	23,290
2019	20261	9195	19,636
2020	14633	9388	14,464
2021	16534	10568	16,060
2022	24310	14816	23,899
2023	24,978	15,614	24,626
Source: Mongolian Statistical Information Service			

As shown in Figure 4-71, when comparing the number of registered crimes in the project-affected districts of Sukhbaatar and Khan-Uul, Sukhbaatar District recorded the highest number, with a total of 19,181 crimes registered between 2018 and 2023[148].

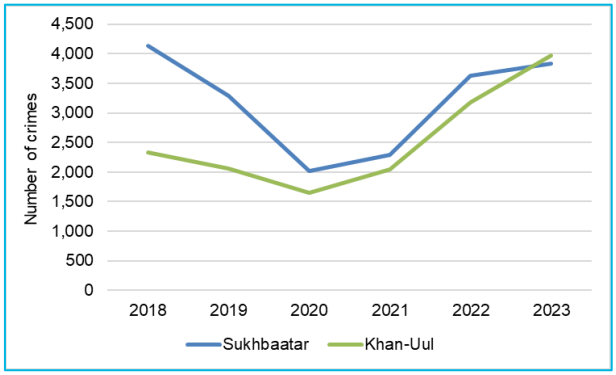

Figure 4-71 Number of recorded crimes, 2018-2023

[147] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/573071/table-view/DT_NSO_2300_046V1
[148] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/573071/table-view/DT_NSO_2300_046V1

4.17.7 Health

In Ulaanbaatar city, the number of health organizations operating in the health sector was 2617 in 2018, 2689 in 2019, 2773 in 2020, 2962 in 2021, 2880 in 2022. In 2023, the number increased to 4,061, which is a 41% rise compared to the previous year[149].

Sukhbaatar district: Sukhbaatar district's Health Center was originally established in 1970 under the name "Children's Hospital № 2" and has been operating as the Sukhbaatar District Health Center since 2014.

A total of 233 staff members are employed at the health center, including 72 general physicians, 72 nurses and allied health professionals, 38 administrative staff, 8 other professionals, and 43 support and maintenance personnel. Among the specialists, 6 (3%) are clinical professors, 5 (6.9%) are senior-level physicians, 18 (25%) are mid-level physicians, 4 (5.5%) are senior-level nurses, and 29 (40.2%) are mid-level nurses. Additionally, 190 staff members are employed at 18 family health centers affiliated with the district. The Sukhbaatar District General Hospital (SBDGH) provides the following services:

- Outpatient consultation
- Diagnostic and laboratory services
- Day treatment
- Inpatient care
- Traditional medicine
- Rehabilitation services
- Day chemotherapy
- Day radiotherapy
- Palliative care

Khan-Uul district: The Health Center operates with 4 departments and 9 divisions, employing 56 physicians, 65 nurses and mid-level medical professionals, 57 other technical and administrative staff, and 10 contracted personnel, for a total of 205 positions. It has 46 specialists, 27 diagnostic and paraclinical rooms, and a 90-bed inpatient ward. The center provides primary and secondary level specialized medical services to over 209,524 residents of the district. Under its jurisdiction, there is 1 independent outpatient clinic and 14 family clinics operating across khoroos 1 through 16[150].

As shown in Table 4-47, a total of 642,991 individuals received medical consultations and diagnostic services at the Khan-Uul District Health Center in 2021, and this number increased to 774,732 in 2022.

Table 4-47 Health indicators of Khan-Uul district

	2021			2022			
Items	Actual number	Per 10,000 population	Average of city	Actual number	Per 10,000 population	Average of city	Difference
Population	190589			202726			12137
Outpatient visit at a health facility	642991			774732			131741
Number of mothers delivered child	4760			4866			47
Live births	4806			4866			60

[149] National Statistic Office. https://www.1212.mn/mn/statistic/statcate/48171317/table-view/DT_NSO_2100_008V2
[150] https://www.huemn.ub.gov.mn/?page_id=1962

	2021			2022			
Cases of communicable diseases	25115	1317.8	1581.2	25265	1246.3	1245.1	150
Covid-19	24758	1299	1533	24398	1203.5	1165.9	
Syphilis	59.	3.1	13.1	83	4.1	17.1	24
Impantients	4272			4116			-156
Occupied bed-days	32667			30450			-2217
Sources: https://www.huemn.ub.gov.mn/?p=18178							

4.17.8 Waste

The planned route of the "Ulaanbaatar Public Transport (Light Rail Transit-LRT) from General Archives to Sukhbaatar Square" project planned to encompass the territories of Sukhbaatar and Khan-Uul districts. The municipal public waste within the area designated for project site is currently managed by the Department of Urban Development ONUAATUG[151] of Capital City.

4.17.8.1 Project waste

Waste generated from the "Ulaanbaatar Public Transport (Light Rail Transit-LRT) from General Archives to Sukhbaatar Square" will be managed in accordance with the Law on Waste of Mongolia and the following regulatory frameworks: General requirements for the classification, collection, transportation, recycling, recovery, disposal, and landfilling of non-hazardous waste (Annex to Order No. A/443 of the Minister of Environment and Tourism, dated November 17, 2018); Methodological guidelines for establishing, operating, and closing centralized non-hazardous waste facilities (Annex to Order No. A/445 of the Minister of Environment and Tourism, dated November 19, 2018); Licensing procedures and requirements for entities engaged in the transportation, collection, storage, recycling, disposal, and export of hazardous waste (Annex to Order No. A/18 of the Minister of Environment and Tourism, dated January 30, 2018); The categorized list and classification of waste types generated from source (Annex to Order No. A/349 of the Minister of Environment and Tourism, dated December 12, 2017).

Under the project, household waste will be temporarily stored at designated collection points and regularly transported under an official contract with the Department of Urban Development ONUAATUG of Capital city. Solid waste must be disposed of at authorized landfill sites according to a fixed schedule and approved waste management plan.

As the project involves road construction activities of Light Rail Transit, both hazardous and municipal waste may be generated during implementation.

Two main types of waste are expected to be produced:

- Liquid waste:
  - Lubricants and oil residues and domestic wastewater
- Solid waste:
  - Municipal solid waste and construction and demolition debris

Hazardous waste generated during project activities will be separated and collected at designated points, then transported to the centralized hazardous waste collection facility of Ulaanbaatar city. Municipal and construction-related solid waste will be removed under a formal agreement with the Department of Urban Development ONUAATUG of Capital city.

[151] https://htg.ub.gov.mn/

5. Potential Environmental and Social Impacts and Mitigation

5.1 Methodology

In order to assess the impacts, a baseline study was performed to describe the relevant environmental and social issues that are present in the area of the proposed project that could be potentially affected either during construction or operation. A scoping assessment was undertaken to identify potential environmental and social impacts. The assessment of the impacts has concentrated on identifying the likely significant residual effects of the proposed project. For this, impacts were first assessed without taking into account of mitigation measures, with the significance of the impacts being a function of several criteria including:

- Receptor sensitivity:
  - Humans (local communities, local economy, etc.)
  - Environmental components, both living (habitat, flora, fauna, etc.) and non-living (air quality, water bodies, landscapes, etc.)
  - Cultural heritage components (archeological sites, etc.)
- Nature and Type of Impacts: Whether an impact is considered to be positive or negative (impact nature), and the way in which it is related to the project (impact type: direct, indirect, induced, and cumulative) are central to the ESIA process. Impact types comprise:
  - Positive or Negative – Impacts of a proposed action can be positive or negative. A positive impact is one having beneficial outcomes on an environmental or social resource. A negative impact is one having adverse, unfavorable, or undesirable outcomes. A single action might result in positive impacts on one environmental or social resource and negative impacts on another resource.
  - Direct or Indirect – Impacts can also be direct or indirect. A direct impact is caused by an action and occurs contemporaneously at or near the location of the action. An indirect impact is caused by an action but might occur later in time or be farther removed in distance but still be a reasonably foreseeable outcome of the action.
  - Cumulative – Cumulative impacts 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 impacts identification process is conducted.
- Impact magnitude measures the change from baseline conditions that is predicted to occur in a resource or receptor. This measure of change is described in terms of its:
  - Intensity – Severity of the impact (i.e., degree to which the proposed action would affect the resource or receptor)
  - Extent – Spatial extent of the impact (e.g., site, local, regional, national, or international)
  - Duration – How long the impact will interact with the receiving environment (e.g., temporary, short-term, medium-term, long-term, or permanent)
  - Frequency – How often the impact will occur (e.g., once, occasionally, regularly, frequently, continuously)

Assessment of the overall magnitude of impact, therefore, takes into account all the dimensions of the impact — i.e., intensity, extent, duration, and frequency — to determine whether an impact is of **negligible**, **low**, **moderate** and **high** magnitude.

- Likelihood of the impact occurring.

Mitigation measures were then developed for each adversely affected environmental or social aspect identified, and an evaluation of the likely effectiveness of the measures to prevent, mitigate or compensate the adverse impacts undertaken. Finally, based on the significance of the effect and the assessment of the probability of success of the proposed mitigation, the significance of the residual effect was determined.

5.2 Potential Environmental and Social Impacts and Mitigation

The potential environmental and social impacts of the construction and operation of the "Ulaanbaatar Tram Project from the General Archives to Sukhbaatar Square" project identified and assessed. It is important to note that, the decommissioning[152] of the railway line has not been considered. Because Ulaanbaatar City always wil require public transportation system and therefore effectively the useful life of the this prposed project would not end and the public transportationsystem would not be decommissioned. Rather, when needed, the proposed project components (e.g., extention of some components in the future) would be redesigned and reengineered and reconstructed to upgrade specific processes and equipment. These activities would be undertaken inherent to the operation and maintenance phase and in accordance with the design standards, and environmental procedures and regulations current at that time. Therefore, potential environmental and social impacts eliminated decommissioning from this study.

Thus, based on the EBRD Performance Requirements (PRs), the environmental and social impacts identified and assessed during the construction and operational phases are summarized in the Table 5-1 overleaf along with a summary of the key mitigation measures.

With mitigation the majority of the environmental impacts arising from the construction of the "Ulaanbaatar Tram Project from the General Archives to Sukhbaatar Square" project are not anticipated to be of a significant nature except for the removal of top soil and distturbunce of vegetation cover, but some forest or shurabs could be affected as described in Section 4.13. However, localized effects on noise levels and air quality. The operation of the proposed project may result in less effects on environmental components, as compared with the construction phase.

The propsed project will require temporary land take during construction which will give rise to the temporary loss of some land. After construction this land will be reinstated, where possible, to its baseline condition. Involuntary Resettlement and Economic Displacement could be occurred as explained in 3.6.1. It is important to note that, according to this EBRD PR5, not only those who have legal title are entitled for compensation, but also those who do not have legal rights that are directly affected by the proposed project.

[152] In General, decommissioning refers to making a project inoperative and dismantling the structural elements or components at the end of the project lifecycle.

With the application of the mitigation measures during the operational phase, the majority of residual negative social effects are anticipated to not be of a significant nature, except for community disturbance and safety risks arising from the proposed project operation. Thus, operator company will need to carefully manage and monitor any issues related to community safety and on the safety of workers from the operation of a tram. Noise and vibration disturbance from the operation of the tram may affect the quality of daily life of local communities who live along the route and or near by tram depot.

The proposed project is expected to have a positive, long-term and significant residual effect on the Ulaanbaatar City economies. For example, economic growth at a local level and create local employment opportunities could be increased during the construction phase. In other words, business opportunities may also potentially increase significantly for local contractors and especially subcontractors during construction phase. Significant economic, employment and educational benefits are anticipated to arise as a result of the operation of the proposed project at a local. These economic benefits should provide improvements in the quality of daily life of local communities of Ulaanbaatar.

Table 5-1 Summary of Environmental and social Impact Assessment Matrix

Component	Potential Impacts or Benefits	Mitigation and Management Measures	Significance of Residual Impact
Environment:			
Landscape	Temporary change of landscape.	Screening of construction sites, camps and areas.	Low negative
Soil	Impacts on soil quality and soil Erosion and topsoil disturbance where construction work take place at natural conditon (e.g constrcution of tram depot and between paved road in some area along proposed trass of tram road) Leaks and spills leading contamination and may affecting future use of soils	**Waste management plan (see Appnedix A), Emergency Preparedness and Response Plan (see Appnedix B)** will be developed prior to construction works starting. **Soil Management Plan and Worker Camp Management Plan** shall be prepared for the controlled removal of top soil, appropriate storage and reuse prior to construction works starting.	Low to Moderate negative
Air	Impacts on air quality during construction: Increased air emissions due to dust and exhaust emissions	**Dust Management Plan**: measures to avoid/minimize dust emissions and **Traffic Management Plan** will be prepared and to optimize vehicle movements and plan vehicle movements to avoid peak times and heavily trafficked routes. Application of clean water to control of dust would be required	Moderate negative
Noise & Vibration	Impacts on noise levels from construction vehicles and machinery.	**Occupational Health and Safety Plans** will be prepared in order to protect the safety, health of workers and local communities. Install noise barriers at sensitive area (e.g., near local communities area). Construction equipment will where possible comply with relevant noise emission MNS. All equipment will be fitted with appropriate noise reduction devices. Regular maintenance of vehicles and machinery. Restricted working hours for construction works. **Traffic Management Plan** will establish speed limits for construction vehicles to avoid as much as possible at sensitive receptors (e.g., near local communities area). Local communities will be kept informed of planned works.	Low to Moderate negative
Surface Water	Impacts on surface water (e.g., Tram route will pass Selbe and Tuul River) Suspended solids in surface runoff resulting in deterioration of water quality Leaks and spills causing contaminated runoff or infiltration and transport through groundwater resulting in deterioration of water quality	Potential for increasing turbidity, sediment loads and contamination in the downstream. Thus, works near watercourses will be carefully managed and no occupation of the stream bed or the banks will be allowed. Also safeguarding of open excavations and Erosion control, Protection of streams and surface water and final cleaning of site and temporary sanitary conveniences and Storage and handling hazardous materials would be required.	Moderate negative

Component	Potential Impacts or Benefits	Mitigation and Management Measures	Significance of Residual Impact
		Waste management plan (see Appnedix A), Emergency Preparedness and Response Plan (see Appnedix B) will be developed prior to construction works starting	
Ground water	Impact on ground water quality. Alteration of ground water flow patterns.	**Hazardous Waste Management Plan** and **Emergency Preparedness and Response Plan (see Appnedix B)** shall be prepared as prevention measures to avoid groundwater contamination.	
Fauna	Proposed project would be implemented in Ulaanbaatar City which is modified habitat area. Thus, no direct impacts on fauna	Prior to the works a fauna survey shall be carried out by biodiversity expert if required.	Low negative
Flora	Proposed project would be implemented in Ulaanbaatar City which is modified habitat area. However, green place and some trees can be affected affected (see Section 5.13 of this Report)	A **Relocation of Tree Plan** (BMP) will be prepared and implemented before to construction works starting.	Moderate negative
Culture Heritage	Proposed project would be implemented in Ulaanbaatar City where high populated area, Thus, no archaeological sites in Area of Influence	Chance find procedure.	Low negative
Social			
Land & Property	Temporary or permanent land loss and effect on livelihoods.	**Detailed household survey** of land take in Section 4.6 and 4.16, taking into consideration those without legal rights over properties and belongings. **Resettlement Action Plans (see Appendix C)** will be prepared prepared and implemented before to construction works starting. Project affected people will be duly compensated in accordance with the Resettlement Compensation Framework. Additional assistance will be provided to the people who will be resettled.	Moderate negative
Community Health & Safety	Impacts from influx of temporary workers. Impacts from increased community exposure to disease. Safety issues associated to the construction activities	**Health & Safety Plan** and an **Emergency Preparedness and Response Plan (see Appendix B)** will be developed prior to construction works starting. **Traffic Management Plan** for safe access to construction sites and to minimise impacts on the existing roads. Local communities will be kept informed of planned works. Prepare training materials and provide training on community health and safety and conflicts with the local community members Labour code of conduct shall be signed.	Low to Moderate negative

Component	Potential Impacts or Benefits	Mitigation and Management Measures	Significance of Residual Impact
		Any material damage made by workers will be subject to fair compensation. Security arrangements for contractor facilities will be carefully designed and managed. Worker camps will be located outside the communities and eshtablish security arrangements. Local Workforce Recruitment Plan to assure employment of as much as possible local.	
Workforce	Accidents and impacts on workforce.	**Grievance mechanisms** will be developed and implemented **Labor Management Plan (see Appendix D)** will be developed and implemented **Emergency Preparedness and Response Plan (see Appendix B)** will be developed prior to construction works starting for the management of cases of incidents during the construction phases in term of transportation of raw materials/hazardous substances. **Occupational Health and Safety Plan** will be prepared in order to protect the safety, health of wrokers. Human Resources Policies in line with national legal framework and EBRD Environmental & Social Policy and will include Employer safeguards against discrimination. Workers camps will be constructed outside existing and monitored in line with EBRD & IFC guidance on Worker Accommodation.	Low to Moderate negative
Disruption of Utilities	Effects of utility cuts on local businesses and communities.	Work permission must be obtained prior to construction works. Public notification of any disruption of utilities (e.g. cut of supply of water and electricity, etc).	Low to Moderate negative
Public access	Impacts on public access due to construction works	**Traffic Management Plan** will be developed including identification of all public roads and paths that will be affected public accessto minimize traffic disturbance and signing of the construction areas/diversions and Public notification of any traffic-related issues (e.g. road closures).	Low to Moderate negative
Economy	Creation of local employment. Business opportunities may also potentially increase significantly for local contractors	**Local Recruitment Plan** will be developed for employment of local workforce and engagement of women, where appropriate.	Moderate Positive
Education & Training	Capacity building through training	Contractor will be responsible for providing to train their employees including the local workforce.	Moderate Positive
Locol Communities and Vulnerable	loss of land, properties and job	Compensation in accordance with the Resettlement Compensation Framework based on **Resettlement Action Plans**	Moderate Positive

Component	Potential Impacts or Benefits	Mitigation and Management Measures	Significance of Residual Impact
Groups		**Stakeholder Engagement Plan (see Appendix E)** will be developed and implemented	
Operation Phase			
Environment:			
Landscape	Alteration of landscape by the presence of the tram.	Landscape planting as specified in Feasibility Study report	Moderate negative
Soil	No direct impact on soil erosion, as compared with the construction phase. Leaks and spills leading contamination at tram maintenance area in tram depot.	**Emergency Preparedness and Response Plan (see Appendix B)** will be implemented	Low negative
Air	Impacts on air quality.	The Tram will be operated under electric traction and no major air emissions are expected in this stage	Low negative
Noise & Vibration	Impacts on noise levels (electrical traction). Vibration from tram traffic.		Low negative
Surface Water	Impact on water quality; Wastewater.	Domestic wastewater will be treated and discharged according to the relevant Mongolian legislation	Low negative
Ground water	Impacts on groundwater quality.		
Fauna	No direct impact on fauna, as compared with the construction phase.	No specific mitigation measures required.	Low negative
Flora	No direct impact on flora, as compared with the construction phase.		
Culture Heritage	No impact	No specific mitigation measures required.	
Social			
Land & Property	Effects on livelihoods	**Public Information notices and Public awareness initiatives:** • local communities along the tram track to be informed about operation of tram • no crossing of the tram track other than at the designated crossing points, • for increasing the public awareness of the tram, etc	Low negative
	better access to the larger towns and health services		Moderate positve
Community Health & Safety	Safety issues from crossing of Tram track. Noise and Vibration Electromagnetic fields	Safety barriers and signage to prevent access to the tram corridor. Anti noise barriers would be installed where necessary. Ensure continuously maintenance of wheels, track bed and rails	Low negative
Workforce	Tram workers' safety during operation of Tram.	Operational **Emergency Preparedness Plan** and **Safety Program** will be developed and imlemented.	Low negative

Component	Potential Impacts or Benefits	Mitigation and Management Measures	Significance of Residual Impact
Disruption of Utilities	Effects of diversions of utilities on local businesses and communities		Low negative
Public access	Impact on public access		Low negative
Economy	Economic growth at a local level and create local employment opportunities could be increased		Moderate positive
Education & Training	Education and training benefits from employment opportunities and from improved access to public services		High positve
Vulnerable Groups	Effects on vulnerable people during operations	Operator company will continue to inform general public and vulnerable groups residing along the track in order to increase their safety awareness	Moderate Negative

6. Environmental and Social Management and Monitoring

Environmental and Social Management and monitoring plan along with a number of specific Environmental and Social Management Plans, including a Dust Management Plan, Waste Management Plan, Traffic Management Plan, Emergency Preparedness and Response Plan, Stakeholder Engagement Plan, etc for “Ulaanbaatar Tram Project from the General Archives to Sukhbaatar Square” project has been prepared in Section 5. The Environmental and Social Management and Monitoring Plan describes the environmental and social mitigation and monitoring measures, the criteria for their successful implementation and the organizational measures to be implemented during the pre-construction, construction and operation of the proposed Project.

The Environmental and Social Management and Monitoring Plan will need to be regularly reviewed and updated as the Project evolves to reflect any changes in the Project implementation and organization as well as in regulatory requirements.

For each identified impact a monitoring protocol will be established that will define the objective of the monitoring, the description and timing of monitoring activities, the indicator to measure the effectiveness of the measure, and any thresholds to be taken into account. Monitoring reports will be required from the Contractor/Operator during the construction and operational phases. These will be submitted to the relevant inspection authority.

The goal of the Environmental and Social Management and Monitoring Plan is to ensure that all necessary mitigation measures are carried out to counter any adverse environmental impacts, and that enhancement measures are used where feasible and practical. The Environmental and Social Management and Monitoring Plan will allow for redesigning mitigation measures if from the monitoring it is observed that the mitigation measures are not working.

Appendix A: Generic Waste Management Plan

The waste management plan (WMP) will be developed in accordance with the Mongolian regulatory framework, European Bank for Reconstruction and Development (EBRD) Environmental and Social Policy (ESP) and EBRD Performance Requirements (PRs) and good international practice (GIP).

The WMP shall be prepared for "Ulaanbaatar Tram Project from the General Archives to Sukhbaatar Square" project. The Contractor must be developed its own site-specific WMP in line with the requirements of EBRD and Mongolian relevants laws.

The WMP outlines the mitigation measures and strategies to be implemented during the for "Ulaanbaatar Tram Project from the General Archives to Sukhbaatar Square" project activities to minimize and mitigate the adverse impacts resulting from waste generation. Furthermore, the WMP also includes training, monitoring and reporting requirements for Contractor in order to mitigate adverse impacts of waste generation.

Overview of Waste Management Plan

WMP is a site-specific plan and its main purpose is to avoid any potential adverse impacts caused by waste on workers, local communities and environmental receptors (such as soil, water and so on) as well. In order to meet the purpose, WMP has to be developed to identify waste streams (e.g., waste types and quantity) that would be generated during the associated construction activities of "Ulaanbaatar Tram Project from the General Archives to Sukhbaatar Square" project and define mitigation measures where required.

Before the start of any construction activities, the contractor must update its own WMP based on this preliminary management plan for the approval of Engineer. The WMP shall be implemented before and throughout the construction phase and must be in compliance with the standards, requirements and laws detailed in below. The objectives of this plan are as following:

- Defines roles and responsibilities for implementing mitigation measures defined in this plan.
- Outlines the framework for managing waste generation in accordance with Mongolian national law, regulations and requirements of the EBRD ESP and PRs.
- pecifies measures to ensure wastes are managed sustainably, minimized, characterized, segregated at source, stored appropriately, transported by approved carriers, reused and recycled where possible and disposed of at suitable facilities.
- Sets a general framework for managing wastewater generated from the camp sites as well as construction area activities.
- Outlines monitoring, training, and reporting requirements.

This WMP has to be addressed to all workers of the contractor who are carrying out construction activities. Therefore, the waste generated from project activities which will be performed under the supervision of Contractor, will be managed in accordance with this WMP.

Principles of Waste Management Hierarchy

Waste management hierarchy of contractor was developed on the basis including the requirements of Mongolian law on waste and requirements of the EBRD ESP and PRs. Each of the requirements has common approach that considers reducing waste at construction site, reuse, recycling, recovery and disposal. However, the implementation sequence of waste management hierarchy approach may vary depending on the project activities. For instance, requirements of Mongolian law and EBRD PR3 have adopted more detailed waste management hierarchy than other requirements as shown in Table 1.

Table 1. Waste management hierarchy

Requirements	Waste management hierarchy
Mongolian law on waste	• Reduce • Reuse • Recycle • Recover • Disposal
EBRD PR3	• Minimize • Reuse • Recycle • Recover • Disposal

In consideration of the waste management approaches shown above, a four-level hierarchy for waste management has been developed for this WMP. The levels of this hierarchy from most desirable to least desirable are reduce, reuse, recycle and dispose (see Figure 1). In this regard, the Contractor would first and foremost take actions to reduce the total amount of waste generated during construction activities and on site.

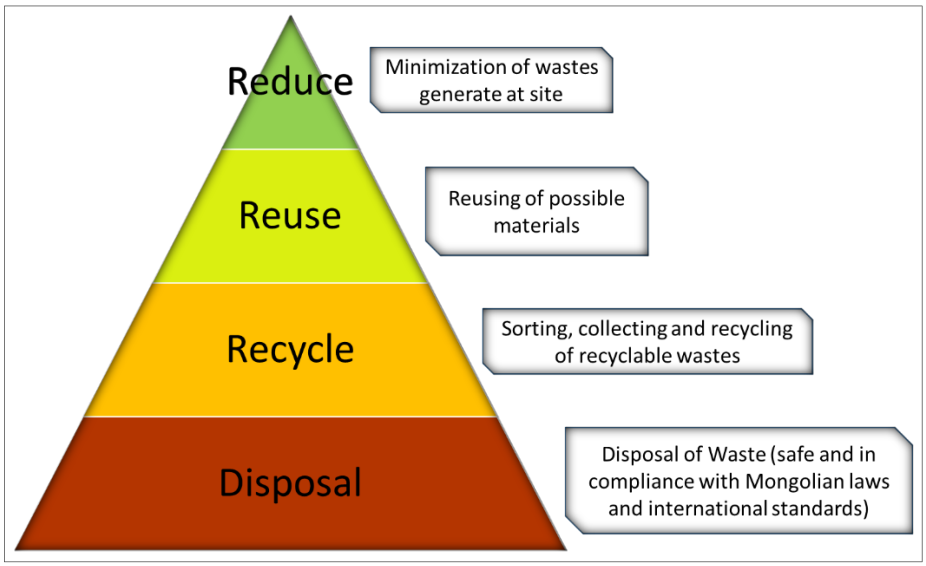

Figure 1 Waste Management Hierarchy

Implementation of Waste Management Plan

The implementation of the WMP is aimed to mitigate potential impacts due to waste generation. The objective of the WMP is to ensure effective waste management by minimizing waste generation and safely handling, storing, treating, and disposing of generated waste. Mitigation measures in accordance with the above-mentioned standards and requirements to be implemented by Contractor are described in further sections.

Waste Classification: Categorization of wastes are described in both EBRD PR3 and Mongolian Waste. For the purposes of this WMP, both EBRD PR3 and Mongolian Law waste categorizations were studied and compiled. For EBRD PR3, waste is generally categorized as hazardous and non-hazardous. On the other hand, the Mongolian Law on waste classifies waste in more detail where wastes are described as hazardous, non-hazardous, and construction wastes. Generally, wastes would be categorized into three main types in term of their properties:

- Inert waste (e.g., construction materials);
- Non-hazardous waste (e.g., food waste, glass, plastics, metals-drinking cans and general mixed waste);

- Hazardous waste – (e.g. construction hazardous waste, machinery oil, lubricants, and medical or healthcare waste from first aid activities and contaminated wastes);

Waste Streams and Management at Site: Contractor will subcontract a licensed waste management company and/or for the collection, transport and disposal of waste produced at site. Wastes at the sites and the camp facilities shall be segregated and collected at the temporary waste storage area. The temporary waste storage area will have separate storage segments for prime recyclables (scrap metals, tire, plastic, wooden material), and separate segment for other hazardous waste including waste oils, oil filters etc. Moreover, properly store on site all hazardous wastes will be conducted for which there is not an engineered and approved treatment or disposal method available until a treatment and/or disposal route becomes available.

Special care will be taken to ensure that liquid wastes are kept in containers/bins with secondary containment. Proper waste segregation will be maintained at all times. Environmental labelling including visual communication elements shall be applied to the area/ on the containers where appropriate. Table 2 shows the main waste streams, sources and management requirement for all waste generated during the construction phase.

Table 2. Waste, Sources and Management Requirement

Waste Streams	Types of waste stream	Source
Inert waste		
Concrete	Construction waste	Construction activities
Metal scraps	Construction waste	Construction activities
Non-hazardous waste		
per/Cardboard	Non-hazardous waste	Temporary camp
Glass bottles	Non-hazardous waste	Temporary camp
Aluminum cans	Non-hazardous waste	Temporary camp
Waste tires from vehicles	Non-hazardous waste	Maintenance of vehicles
Food waste/general waste	Non-hazardous waste	Temporary camp
Hazardous waste		
Batteries	Hazardous waste	Maintenance of vehicles
Accumulators	Hazardous waste	Maintenance of vehicles
Contaminated Soil	Hazardous waste	Land clearance and excavation area
Fluorescent lighting tubes	Hazardous waste	Temporary camp and facilities
Waste oil and lubricant	Hazardous waste	Maintenance of vehicles
Electrical cables	Hazardous waste	Construction activities
Potentially infectious waste from clinics and healthcare	Hazardous waste	Temporary camp
Cartridges/Toners	Hazardous waste	Temporary camp and facilities
Medical Waste	Hazardous waste	Temporary camp and facilities
Asbestos cement	Hazardous waste	Rehabilitation/ improvement of pipes

Waste Management at Site

As part of the WMP, mitigation measures will be implemented by contractor in order to avoid or minimize the potential adverse impacts of waste on environment and human health. Waste storage must be on a short-term basis. Some materials may be stored on a longer-term basis until sufficient volume is accrued to support collection and disposal. Following mitigation measures will be taken in order to avoid potential adverse impacts: but not limited (e.g., contractor must be updating these mitigation measures)

- Comply all requirements of Mongolian and EBRD regulations
- Ensure that all debris and excess material will be disposed of outside wetland or floodplain areas in an environmentally sound manner.
- Ensure that waste management hierarchy shall be implemented on the project site,
- A spill kit, first aid kit and fire extinguisher will be placed near the temporary waste storage area.
- Assign a principal points of material use material safety data sheets (MSDSs) for all stored waste materials
- Ensure that hazardous wastes and materials shall be temporarily stored, safety handled and transported to designated area.
- Location of asbestos pipes should be mapped. Pipes to be removed when encountered during the construction works. Asbestos cement pipes should be handled and disposed of appropriately, requiring: procedures for safe handling, removal and disposal of asbestos-containing materials to avoid exposure risk. This would include development of a manual and training in the correct handling of asbestos pipes when doing repair or maintenance work and development of instructions and provide appropriate personnel protective equipment (PPE) for conduct of such work.
- Ensure that segregation of solid waste and contract with the local Public Service Company for disposal to the nearest landfill.
- Implement Emergency Preparedness and Response Plan (EPRP) when any spill occurred.
- Ensure that proper safe work practices to prevent or reduce potential exposure, including use of personal protective equipment and emergency response.
- Training will be provided to all workers regarding proper waste management.
- The following will be prohibited:
    - Long-term accumulation at the waste disposal site.
    - Disposal of hazardous waste in solid household waste containers.
    - Mixing of liquid and solid hazardous waste.
    - Mixing hazardous waste with other types of waste in order to neutralize it.
    - Collection and storage of liquid hazardous waste in open areas exposed to atmospheric precipitation.
    - Burning of rubber or other waste.
    - Disposal of hazardous waste into groundwater and/or surface waters.
- All waste disposals carried out by waste sub-contractors will be documented in the Waste Disposal Form (Annex 1 of this generic plan).
- Wastewater must be appropriately managed

Training

The contractor shall ensure that all workers have been informed about this WMP and inducted in the waste management training in order to maintain appropriate level of awareness of workers on waste management actions and their responsibilities.

Training on waste management will be provided to all workers prior to start of any construction works. This training will be organized and delivered by Contractor or an organization specialized in waste management (if necessary). The waste management training includes topics including but not limited to:

- Basic principles of waste management;
- Waste management hierarchy;
- Waste segregation;
- Waste collection and storage;
- Hazardous waste management;
- Material handling and housekeeping.

The training session must be properly recorded on the attendance sheet. For the purpose of keeping records after the training program, the sheet will be handed out and signed by each participant. The details of the date, location, attendees, and topics covered will also be noted.

Monitoring

Monitoring actions related to WMP will be carried out by contractor in order to ensure compliance with project's requirements. Monitoring may identify necessary changes to the project activities that are required to meet the corresponding requirements (e.g., WB ESSs and Mongolian Laws). Table 3 describes the monitoring activities to be undertaken, indicator and criteria used for verifying the effectiveness of the WMP implementation.

Table 3. Monitoring Action for WMP

Waste management	Task	Type	Period
Non-hazardous waste generated (kg/ton)	Measure	Monthly	N/A
Hazardous waste generated (kg/ton)	Measure	Monthly	N/A
Inert waste (kg-ton)	Measure	Monthly	N/A
% of waste segregated	Measure	Monthly	90 %
Waste recycled (kg/ton)	Measure	Monthly	N/A
number of grievances received related to WMP implementation	Measure	Monthly	0
Instances of off-site contamination identified	Measure	Monthly	0%
Number of reported incidents of hazardous material releases leading to actual or potential harm to humans or the environment	Measure	Monthly	N/A
Number of reported waste incidents	Measure	Monthly	N/A
Indicators and Success Criteria, but not limited: ***Indicators:*** • **Submission of site-specific Waste Management Plan to Engineer** • **Amount of total waste generated and waste transported for off-site recycling** • **Number of reported waste incidents and community complaints** • **Number of reported potential and actual incidents of human and environmental harms from hazardous material release and off-site contaminations** • **Number of reported non-compliances and deviations of the mitigation measure** ***Success Criteria:*** • **Approval of site-specific Waste Management Plan by Engineer** • **Minimization of total waste generated and minimization of waste transported for off-site recycling** • **No occurrences of waste incidents and community complaints** • **No occurrences of potential and actual harms on humans and environment from hazardous material release and off-site contaminations** • **No occurrences of non-compliances and deviations of the mitigation measure**			

Reporting

Contractor will prepare and submit the site-specific Waste Management Plan and other relevant documentation for written approval of Engineer. Moreover, the contractor will report the following activities:

- Update performance relative to indicators and comparison to respective success criteria, as listed above and detailed in the plan.
- Summarize other activities undertaken during reporting period.
- Specify any material deviations or non-compliances to this mitigation measure, and any other issues of concern.
- Define activities planned during next reporting period.
- All trainings will be recorded and archived at site office with its attendance sheets including date, topic, signs of attendees for audit purposes.
- Any spill to be resulted from waste related environmental incident will be recorded and necessary action will be taken as per EPRP.

Grievance Redress Matrix is part of Stakeholder Engagement Plan (SEP). Any case of waste relevant grievances issued by local community; it will be recorded to the Matrix to be followed up.

Waste Disposal form (Annex 1) together with its payment bill will be archived by Environmental and Social Team at site office. In addition, Waste Register (Annex 2 of this Generic Plan) will keep accurate and comprehensive records of all waste which is transported and disposed.

Annexes of WMP

Annex 1. Waste Disposal Form:

Originator/Organization Name:_____ Disposal Date:_____

Organization Address:_____

Transportation Company:_____ Plate Number:_____

Address:_____

Type of Transport:_____

Responsible Person Name:_____ (sign)

Waste Receiver/Buyer Company Name:_____

Type of Waste	Weight or Quantity (kg, lt, m^3,pcs)	Detailed information

Annex 2: Waste Register:

Hazardous waste type	Waste Form (solid or liquid)	Unit (kg, L, m^3, pcs)	Total amount of waste disposed of	Date of disposal
Hazardous waste type				
Accumulator or batteries				
Used waste oil from maintenance of vehicles				
Contaminated soil				
.....				
Non-hazardous waste type				
Aluminum cans				
Construction Debris				
Domestic waste				
.....				
Inert waste type				
Stone				
Gravel				
…….				

Appendix B: Generic Emergency Preparedness and Response Plan

The Emergency Preparedness and Response Plan (EPRP) has been developed in accordance with the Mongolian regulatory framework, European Bank for Reconstruction and Development (EBRD) Environmental and Social Policy (ESP) and EBRD Performance Requirements (PRs) and good international practice (GIP).

The EPRP shall be prepared for "Ulaanbaatar Tram Project from the General Archives to Sukhbaatar Square" project. The Contractor must be developed its own site-specific EPRP in line with the requirements of EBRD and Mongolian laws (see Section 2 below) and be approved by the Engineer.

The EPRP outlines the mitigation measures to be implemented during the "Ulaanbaatar Tram Project from the General Archives to Sukhbaatar Square" project construction activities to avoid significant adverse impacts for environmental and social emergency conditions such as any emergency cases for environment (e.g., any spills or leaks occurrence and etc.). Furthermore, the EPRP also includes training, monitoring and reporting requirements for Contractor in order to mitigate adverse impacts of waste generation.

Overview of Emergency Preparedness and Response Plan

EPRP is a site-specific plan and its main purpose is to avoid any potential adverse impacts caused by spills and leaks, storage of fuel and construction hazardous materials and fire on workers, local communities and environmental receptors (such as soil, water and so on) as well.

Spills and Leaks (chemical, fuel, and etc):

- Refueling
- Transport of chemicals, fuel and hazardous liquids
- Handling, storage and disposal of chemical, fuel and hazardous materials
- Plant and equipment maintenance
- Vehicle wash down
- Concreting activities
- Wastewater overflow

Storage of fuel and construction hazardous materials and fire: but not limited

- Handling, storage and disposal of hazardous materials
- Dismantling of existing structures
- Contaminated soils and contaminated materials
- Site establishment
- Site clearance

Before the start of any construction activities, this preliminary EPRP must be updated by contractor and will be approved by the Engineer. Contractor will be considered following issues when updating this preliminary EPRP:

- Providing instructions for managing and reporting environmental incidents,
- Minimizing and control the risks of any potential environmental spill by development of planned actions,
- Ensuring all workers and sub-contractors are made aware of environmental incidents promptly and can respond accordingly,
- Ensuring site workers understand the immediate environmental spill reporting requirements,

- Ensuring comprehensive and timely communication to relevant external authorities, the community and other stakeholders of environmental incidents,
- Defining roles and responsibilities for implementing mitigation measures defined in this preliminary EPRP
- Outlining monitoring and auditing requirements,
- Describing additional measures required to implement Good International Practice (GIP).

The EPRP applies to all construction areas under the control of contractors' deputy project manager.

Implementation of Emergency Preparedness and Response Plan

The implementation of the EPRP is aimed to mitigate potential impacts identified in the Environmental and Social Management Plan Report. Mitigation measures in accordance with the above-mentioned standards and requirements to be implemented by Contractor are described in further sections.

The EPRP will be implemented by the contractor's ESS in collaboration with HSS at the construction site and and their contact information must be posted at the locations where spills are likely to occur (e.g. hazardous substance storage/handling areas, construction site, waste storage area etc.) on the spill kits and notice boards within the construction sites.

Addition to this, the category of the environmental spill is assigned according to the impacts and severity on the environment. There are two categories of environmental incidents defined in this preliminary EPRP as major and minor as defined follows:

Major Spill: If the impact on the environment is significant but reversible, or irreversible and localized or environmental impact requires a programmed commitment of moderate time and/or money to remediate then the environment incident is **MAJOR**. They can cause serious threat to health and environment.

Minor Spill: If the impact on the environment is reversible and localized or environmental impact requires a programmed commitment of sometime and/or money to remediate, then the environment incident is **MINOR**. These are generally less serious and can be resolved easily.

Mitigation Measures

Contractor will apply followings to prevent or mitigate spill risks during construction phase:

- Provide to all workers, sub-contractors and third parties, all information and training on the nature of these potential hazards as required by Local Laws or Regulations, regardless of the source of such hazards,
- Store, handle and install all materials and equipment according to the manufacturer's written recommendations,
- Store the materials and equipment on a flat, clean, dry surface to prevent damage and shall be covered to prevent exposure to adverse conditions prior to installation,
- Construct and use a separate storage area for hazardous materials used in constructing the work,
- Ensure that hazardous materials shall be stored in groupings according to the Material Safety Data Sheets (MSDS).
- There will containment bunds or spill trays for the storage of the hazardous material,
- The MSDS form will be in place for all chemicals stored,
- Refueling activities will be strictly controlled,
- All the fuel and chemical storages will be stored in an area which has impermeable leakage control,
- All vehicles, equipment and installations will be checked for any fuel and grease leakage before use and will be regularly monitored for leaks,
- Regular maintenance shall be undertaken for all machinery and equipment,

- Adequate amount of appropriate spill equipment and spill kits will be in place at sites where any hazardous material is stored in order to handle with leakages,
- Absorbent pads will be available on each fuel tankers to deal with minor leakages,
- All containers of fuel, lubricant oil and chemicals will be sited on containment bund. The bund will be of sufficient capacity to contain at least the 110% of the volume of the largest tank,
- If there is any leakage occurred to bunded area, it will be collected, stored in hazardous waste temporary storage area,
- Training programs will be conducted for spill prevention, spill kits, refueling procedure, etc.
- Storage of fuel, oils and chemicals on an impermeable base, away from drains,
- Provision of spill kits.

Spill Response Kits

Contractor must ensure that adequate supply of spill kits is available onsite at all locations where a significant spill risk would be occurred (e.g., car parking area, service area, hazardous material storage area, etc). The environmental specilist (ES) or health and safety epeciilist (HSS) will clearly label and store spill response kits in locations that will facilitate a prompt response to spills. Spill response kits will contain at least the following equipment: but not limited

- Shovel - 2 x respiratory masks
- Absorbent material (pads and socks)
- 2 x goggles - 60-liter sealable container
- 2 x PVC gloves - Jug granular absorbent
- Yellow wheelie bin

Response to Spill

This section provides steps of responses to any spill occurs,

- In case of small/minor spills, the ESS or HSS shall use pads wherever is possible to reduce the amount of contaminated material,
- Quickly control the spill by stopping or securing the spill source. Wear personal protective equipment such as gloves and protective clothing if necessary.
- All equipment shall be in designated equipment storage areas including a copy of the appropriate MSDS,
- Remove sources of heat, sparks, flame, and electricity as diesel and petrol vapors are highly flammable and may create and fire/explosive atmosphere,
- If the release exceeds the containment system capacity the construction of additional requirement is needed,
- Notify onsite emergency contacts (ES or HSS) using the chain of command (see Annex I),
- All spilled material, contaminated soil, absorbent material and other contaminated material shall be containerized in a manner consistent with the spilled material's hazard characterization,
- After all recoverable spilled material has been collected and drummed place contaminated soils and articles in containers,
- Dispose of contaminated soils in accordance with applicable local and national regulations; Both the spilled material and the absorbent may be considered hazardous waste and must be disposed of in compliance with Waste Management Plan.
- Spill response action plan together with flow-chart must be developed by contractor.

Risk Control and Response for Workers and Local Communities

According to the EBRD PR4, the potential risks due to emergency events for workers and local communities must be considered by contractor:

- Contractor will prepare an EPRP in coordination with the relevant local authorities and the affected community, and will take into account the emergency prevention, preparedness and response arrangements put into place with project workers
- Contractor will avoid or minimize the potential for community exposure to water-borne, waterbased, water-related, and vector-borne diseases, and communicable and noncommunicable diseases that could result from project activities, taking into consideration differentiated exposure to and higher sensitivity of local communities.
- Contractor will take measures to avoid or minimize transmission of communicable diseases that may be associated with the influx of temporary or permanent project labor.
- Contractor will avoid or minimize the potential for community exposure to hazardous materials and substances that may be released by the project. Where there is a potential for the public (including workers and their families) to be exposed to hazards.
- Contractor will implement measures and actions to control the safety of deliveries of hazardous materials, and of storage, transportation and disposal of hazardous materials and wastes, and will implement measures to avoid or control community exposure to such hazardous material.
- Contractor engaged in projects having the potential to generate emergency events will conduct a risk hazard assessment.
- Contractor will document its emergency preparedness and response activities, resources, and responsibilities, and will disclose appropriate information, as well as any subsequent material changes thereto, to affected communities, relevant government agencies, or other relevant parties.
- Contractor will assist and collaborate with affected communities, relevant government agencies and other relevant parties in their preparations to respond effectively to an emergency event, especially where their participation and collaboration will be an important part of an effective response.

Training

Training will be provided to all workers prior to start of any construction works. This training will be organized and delivered by Contractor. The training program will include elements to ensure that all staff understands the procedures to be followed. Site specific trainings will ensure that all personnel involved in site activities;

- Fully understand the environmental and social risks and emergency situations, and control requirements of the Project and how they will be implemented on site,
- Fully understand the procedures to be followed and mitigation measures to be implemented in the event of emergency situation,
- Awareness of the respective roles with respect to environmental and social emergency

The waste management training includes topics including but not limited to:

- Spills on land and in water,
- Spill prevention and management practices,
- Handling small and large and hazardous spills,
- Use and care of PPE;
- Disposal of contaminated material,
- Emergency communication with project management,
- Tools maintenance.
- Grievance Redress Mechanism (GRM)

The training session must be properly recorded on the attendance sheet. For the purpose of keeping records after the training program, the sheet will be handed out and signed by each participant. The details of the date, location, attendees, and topics covered will also be noted.

Monitoring

Monitoring actions related to EPRP will be carried out by contractor in order to ensure compliance with project's requirements. Monitoring may identify necessary changes to the project activities that are required to meet the corresponding requirements (e.g., EBRD PRs and Mongolian Laws). Table 1 describes the monitoring activities to be undertaken, indicator and criteria used for verifying the effectiveness of the EPRP implementation.

Table 1 Monitoring Action for EPRP

Task	Task	Type	Period
Spill Response			
Number of # of spills to land	Measure	Monthly	0
Number of # of spills to water	Measure	Monthly	0
Trainings completed	Measure	Monthly	100%
Number of times work stopped by the Engineer	Measure	Monthly	0
Workers and Communities			
Total number of grievances arisen from workers	Measure	Monthly	0
Total number of grievances arisen from community members	Measure	Monthly	0
Total % of grievances closed within 30 days	Measure	Monthly	95%
Indicators and Success Criteria, but not limited: ***Indicators:*** • **Submission of site-specific EPRP to Engineer** • **Number of reported incidents** • **Number of workers and community complaints** ***Success Criteria:*** • **Approval of site-specific EPRP by Engineer** • **Successful implementation of EPRP** • **No occurrences of incidents** • **No workers and community complaints**			

Reporting

Contractor will prepare and submit the EPRP and other relevant documentation for written approval of Engineer. Moreover, the contractor will report the following activities:

- Update performance relative to indicators and comparison to respective success criteria, as listed above and detailed in the plan.
- Summarize other activities undertaken during reporting period.
- Specify any material deviations or non-compliances to this mitigation measure, and any other issues of concern.
- Define activities planned during next reporting period.
- All trainings will be recorded and archived at site office with its attendance sheets including date, topic, signs of attendees for audit purposes.
- Any spill to be resulted from waste related environmental incident will be recorded and necessary action will be taken as per EPRP.
- Grievance Redress Matrix is part of Stakeholder Engagement Plan (SEP). Any case of spills and leaks relevant grievances issued by workers and local community, it will be recorded to the Matrix to be followed up.

The ES will provide the following information throughout the construction phase of subproject.

- Trainings: All trainings will be recorded and archived at site office with its attendance sheets including date, topic, signs of attendees for audit purposes.
- Spill Notification and Investigation Form (Annex II): ES or HSS will be documenting the spill in the Spill Notification and Investigation Form.
- Spill Response Register Logbook must be developed by contractor.

- Grievance Redress Matrix and Grievance form are developed within the scope of Stakeholder Engagement Plan. Grievance tracking, recording and reporting will be done within the scope of this plan.

After the implementation of EPRP, all records will be prepared by ES or HSS and will be kept in office till end of the project.

Annexes of EPRP

Annex 1. Spill Response Team

ENVIRONMENTAL EMERGENCY/ SPILL RESPONSE TEAM (CONTACT NUMBERS)			
Position	**Name**	**Phone**	**Language**
Environmental Specialist	.....	……..	.....
Health and Safety Specialist	.....	……..	.....

Annex 2: Spill Notification and Investigation Form:

Spill Notification & Investigation Report					**Incident No #**
Project Name: ……					
Report Date (dd/mm/yy):					
Spill Time and Place					
Date (dd/mm/yy)		Time (hh/mm)		Location & Site	
Person Making the Notification					
Name			Job Title		
e-mail:			Phone Number		
ES or HSS ☐		Contractor ☐		Sub-Contractor ☐	
Actual / Potential Harm or Damage to Environment					
Slight ☐		Minor ☐		Major ☐	
To air ☐		To soil ☐		To water ☐	
Spill Definition & Investigation Findings					
What Happened? (Support with photos etc)					
Rootcauses and Contributory Factors					
Actions Taken					
Actions to Prevent Reoccurrence					
Investigation Team					
Name		**Company**		**Profession/Position**	
ATTACHMENTS					
☐	Employee Interview		☐	Witness Interview	
☒	Training Records		☒	Photos	
Name / Position / Signature/ Date					

Appendix C: Generic Resettlement Framework

The objective and scope of the project is to:

- To construct a Light Rail Transit (LRT) tram system in Ulaanbaatar city's public transportation network with the aim of improving public transport accessibility, improving urban accessibility, reducing traffic congestion, improving traffic organization, establishing new cultural standards and requirements for public transportation, providing services that ensure citizens' comfort and safety, and aligning with Ulaanbaatar city's master plan, architectural and spatial planning solutions, and socio-economic conditions, while studying and determining road conditions to reduce traffic load.
- To construct a Light Rail Transit (LRT) tram system in Ulaanbaatar city's public transportation network with the aim of improving public transport accessibility, improving urban accessibility, reducing traffic congestion, improving traffic organization, establishing new cultural standards and requirements for public transportation, providing services that ensure citizens' comfort and safety, and aligning with Ulaanbaatar city's master plan, architectural and spatial planning solutions, and socio-economic conditions, while studying and determining road conditions to reduce traffic load[153].

The Resettlement Framework (RF) provides overall management of the engagement and consultation activities with project-affected persons[154] (PAP) in the construction stage of the project. The RF describes impacts on structures, access to land and other resources, and communication methods with PAPs.

The Client or Contractor has to be established a sustained relationship with affected Indigenous communities since the early planning stages and has conducted meaningful consultations in accordance with PR 10. Communities actively participated in the design of project activities and mitigation measures, with consultations conducted in a gender-inclusive, multigenerational, and culturally appropriate manner, acknowledging both community diversity and mixed-population contexts.

The Client or Contractor has to be confirmed, through environmental and social assessments and consultations, that project activities do not impact the customary lands or natural resources used by Indigenous Peoples and there are no relocation of the Indigenous Peoples from Traditional or Customary Lands.

Legal and policy requirements

[153] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 20

[154] EBRD's Environmental and Social Policy:

Affected person refers to a legal or natural person experiencing either physical or economic displacement as a result of project-related land acquisition and restrictions on land use, other assets, or natural resources.

Land acquisition refers to all methods of obtaining land for project purposes, which may include outright purchase, expropriation of land and assets, and acquisition of temporary or permanent access rights, such as easements, rights of way, and establishment of restrictions on access to protected and other areas. Land acquisition may also include: (a) acquisition of unoccupied or unutilised land whether or not the landholder relies upon such land for income or livelihood purposes; (b) repossession of public land that is used or occupied by individuals or households; and (c) project impacts that result in land being submerged or otherwise rendered unusable or inaccessible. "Land" includes anything growing on or permanently affixed to land, such as crops, buildings, other improvements, and appurtenant water bodies.

Restrictions on land use refer to limitations or prohibitions on the use of agricultural, residential, commercial, or other land that are directly introduced and put into effect as part of the project. These may include restrictions on access to legally designated parks and protected areas, restrictions on access to other common property resources, and restrictions on land use within utility easements or safety zones.

The Client or Contractor will ensure compliance with relevant national law and legislation and EBRD's Performance Requirement 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement. Its objectives are:

- avoid involuntary resettlement or, when unavoidable, minimise involuntary resettlement by exploring feasible alternative project designs and sites;
- Avoid forced eviction;
- mitigate unavoidable adverse social and economic impacts from involuntary resettlement on affected persons by: (i) providing timely compensation for loss of assets at full replacement cost54; and (ii) ensuring that land acquisition, restrictions on land use, other assets and natural resources and involuntary resettlement activities are implemented with meaningful consultation, participation, and disclosure of information, in accordance with the requirements of PR 10;
- improve, or as a minimum, restore the livelihoods and standards of living of affected persons compared to pre-displacement levels; and
- improve living conditions of physically displaced persons through the provision of adequate housing (including essential services and utilities) with security of tenure55 at resettlement sites.

Stakeholder Engagement

37. Meaningful consultation of affected persons and communities, including host communities, shall be organised by the client throughout the process of resettlement planning and implementation in accordance with principles and processes outlined in PR 10, and shall be supported by disclosure of relevant information, as follows:

- Disclosure of relevant information and meaningful consultation of affected persons and communities shall take place during the consideration of alternative project designs;
- Resettlement and livelihood improvement or restoration shall include options and alternatives from which affected persons and communities may choose;
- meaningful consultation shall take place throughout the planning, implementation, monitoring, and evaluation of the land acquisition and resettlement process, including livelihood improvement or restoration;
- Additional provisions apply to consultations with displaced indigenous peoples, in accordance with PR 7;
- Consultation during the planning phase with all relevant affected groups and stakeholders, including men and women, and vulnerable groups, shall be documented in the resettlement plan required by this PR; and
- Consultation during the implementation and monitoring phases shall be documented.

38. In devising consultation measures, the client shall ensure that all groups, including the vulnerable, are informed and made aware of their entitlements, rights, opportunities, and benefits.

39. The client shall support consultation and engagement efforts with simple, practical, accurate, and culturally appropriate documentation meant for broad dissemination to affected persons.

Since the project has no impact on land acquisition and resettlement, the Contractor's main responsibility is to inform residents about the construction work commencement and keep them informed on construction progress. There are some impacts on PAP's access to roads and other resources, such as water and electricity, so the Contractor will:

- Pay attention to the access block, the safety of project implementation, and any road disturbances.
- Inform private businesses and project-affected communities of any activities that might disturb their business in advance.
- Consider the operations of the affected businesses during the construction work and carry them out according to the work plan.

Project affected person

As diecribed in Section 4.6 and 4.6.1, In selecting the planning route, a total of seven alternatives were developed, compared, and thoroughly studied. These alternatives were evaluated based on several key indicators including primary travel direction, suitability of turns, land acquisition requirements, and engineering infrastructure complexity. Based on this comprehensive assessment, Alternative 1 was identified as the optimal solution and selected for implementation as shown in Table 1.

Table 1 Project: Alternative 1[155]

	Route Option or Route Alternative	Explanation
1		Road Length - 14.6 km Single lane expansion - 2.77 km Double lane expansion - 0.52 km Number of lanes - 2 Railway length - 15.3 km Number of stations - 21 Stations with single-level crossing - 21 Stations with service centers - 0 Rolling stock (vehicles) - 16

Land acquisition for Alternative 1 (see Figure 1) was calculated with widths of 38 meters along Olziit Road, 42 meters along Naadamchid Road, 28 meters along Chinggis Avenue, and 25 meters along Peace Avenue.

As shown in Table 2, the base valuation for land acquisition of 28,245 sq.m across 59 land units affected by the route is 1.4 billion MNT. The valuation for 4,375 sq.m across 7 land units affected by the transformer substation location is 0.56 billion MNT, bringing the total land acquisition compensation to 2.0 billion MNT[156].

Project affected entities will be informed of the resettlement activities, and notification letters will be delivered at least once before construction work commences.

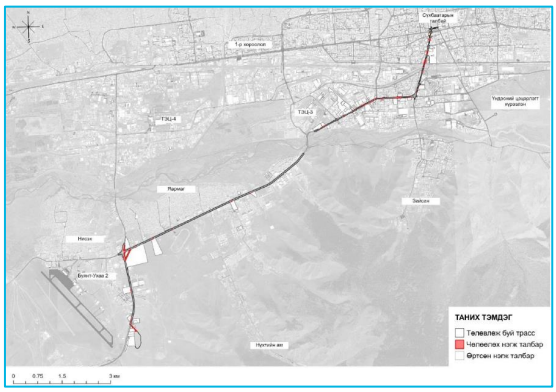

Figure 1 Land Acquisition /Alternative-1/

Table 2 Base Valuation of Land Acquisition for Land Units Affected by the Route /Alternative-1 /

[155] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 125
[156]Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 131

№	Alternative 1	Number of land units	Area (sq.m)	Land acquisition cost (million MNT)
1	Route 2	59	28,245	1,437.7
2	Transformer substation	7	4,375	560
Нийт		Total	**66**	**32,620**

Project affected person engagement

In developing this RF, following core principles focused:

- that public information on the project is a right of the local community.
- that a grievance and complaint mechanism will be established; and
- that stakeholder engagement will be ongoing throughout the project's life.
- Inform the Engineer about the stakeholder engagement and consultation activities.
- Engage with stakeholders in their communities.

Project affected entities will be informed of the resettlement activities, and notification letters will be delivered at least once before construction work commences. Table 3 illustrates planned PAP engagement strategies.

Table 3 PAP Engagement Strategy

	Engagement strategy	Communication methods	Content
Project affected person and entities (PAP)	Inform Awareness raising	• In-person meetings • Printed materials • Official letters • Media or social media channels • Email communication	• GRM • Safety considerations • Duration of construction work

Roles and responsibilities

key roles and responsibilities of the team that will take for the implementation of the RF is shown in Table 4.

Table 4 Roles and responsibilities

№	Role	Responsibility
1	Assistant Project Manager	Provide overall management and support for the implementation of the Project RF Provide sufficient resources to support planned activities Review budget proposals and approve the allocation of resources for practical and effective use
2	Construction manager	Maintain effective collaboration with PAP Develop the RF in collaboration with the Environment and Social specialist Monitoring and reporting of the RF Identify PAP to be engaged and consulted in the project activities Take responsibility for the GRMP implementation. Perform other work necessary for the successful implementation of Project activities.
3	Environment and Social specialist	Maintain effective collaboration with the PAP Keep informing PAP on the project implementation process Notify PAPs before construction work commences Make an agreement that confirms the project activity commencement and finish dates Prepare reports with supporting documents

Grievance redress mechanism

The Contractor implements the Grievance Redress Mechanism (GRM) to prevent violations of the human rights standards and protect employees by setting a clear internal process to receive

and solve grievances, including complaints, requests, and gratitudes, within the project implementation. The Contractor's GRM Plan applies to this plan.

The GRM Plan will cover the Internal and External GRM, including complaints, requests, and gratitude related to labor relations, health and safety, environmental impacts, and administrative issues raised by workers of the Contractor and subcontractors, PAP, stakeholders, and other parties. The contractor will receive a grievance through four different channels and take the required actions according to the GRM process.

Monitoring and reporting

Monitoring:

To evaluate how the objectives of this RF are being met, the Contractor will assess progress towards the performance indicators listed above every month. In cases where monitoring identifies significant divergence from the terms of this RF, Contractor management will be notified, and remedial actions taken as necessary. Success criteria: All residents and companies are well informed and disclosed of the information related to the Project construction activities. Table 6 describes the key performance indicators of the plan.

Table 6 Key Performance Indicators

Measures	KPIs	Target number
Consultation meetings	# of meetings	When required
Notification letter	# of letters	59
Posts on the social media channels of District and Khoroo	# of posts	To be determined
Signed agreement with PAP	# of agreement	To be determined

Reporting:

The Contractor will report to stakeholders on the outcomes of consultations and justify why decisions and actions have been taken. The Contractor will provide monthly updates of activities during implementation of works in the Monthly Progress Reports and annual report to the Engineer and the Client for review and approval.

The report will cover the following information:

- Key performance indicators and measures taken for improvement
- Implementation of planned measures and activities
- Stakeholder engagement and consultation activities were carried out during the reporting period, and grievances were registered and resolved.

Table 7 Reporting schedule

No	Name of Report	Submitted to	Frequency
1	Annual report	To be determined	To be determined
2	Monthly progress report		To be determined
3	Weekly report		To be determined
4	Meeting minutes	To be determined	To be determined

Appendix D: Generic Labor Management Plan

Overview

The Labor Management Plan outlines the Contractor's approach to managing labor relations during the construction project, which details the policies, procedures, goals, strategies, and processes that will be implemented. This plan is developed in alignment with applicable EBRD policies, Mongolian laws and regulations, and the Contractor's internal Human resource documents.

Objectives and Scope

The primary objective of this Labor Management Plan (LMP) is to ensure the effective and professional management of employee labor relations to achieve optimal outcomes. The purpose of this LMP is to protect the fundamental rights of workers and to present the minimum requirements of the employment process, including the protection of fundamental rights of workers, working hours, compensation, and labor agreements, to clearly outline the terms and conditions of employment and to implement a fair, transparent, and inclusive recruitment and selection process.

Principles:

- Uphold and promote the fundamental rights and principles of all workers
- Ensure fair treatment, equal opportunity, and non-discrimination in alignment with the Decent Work Agenda;
- Foster and strengthen a constructive relationship between workers and management;
- Maintain full compliance with national labor laws and applicable collective agreements;
- Safeguard the rights and wellbeing of all workers, with particular attention to vulnerable groups including youth, persons with disabilities, migrant workers, refugees, third-party workers, and those in the supply chain;
- Prohibit the use of forced labor and child labor, in accordance with International Labor Organization (ILO) standards;
- Guarantee that all workers have access to effective and confidential mechanisms for raising and resolving workplace concerns.

Project workers are defined as individuals who are engaged on the project site or perform tasks directly linked to the core activities of the project, including full-time, part-time, temporary, fixed-term, seasonal, and migrant workers—whether employed directly by the client or through third parties.

Project information

The objective and scope of the project is to:

- To construct a Light Rail Transit (LRT) tram system in Ulaanbaatar city's public transportation network with the aim of improving public transport accessibility, improving urban accessibility, reducing traffic congestion, improving traffic organization, establishing new cultural standards and requirements for public transportation, providing services that ensure citizens' comfort and safety, and aligning with Ulaanbaatar city's master plan, architectural and spatial planning solutions, and socio-economic conditions, while studying and determining road conditions to reduce traffic load.
- To construct a Light Rail Transit (LRT) tram system in Ulaanbaatar city's public transportation network with the aim of improving public transport accessibility, improving urban accessibility, reducing traffic congestion, improving traffic organization, establishing new cultural standards and requirements for public transportation, providing services that ensure citizens' comfort and safety, and aligning with Ulaanbaatar city's master plan,

architectural and spatial planning solutions, and socio-economic conditions, while studying and determining road conditions to reduce traffic load[157].

Legal framework

- Applicable International Standards and Guidelines as follows:
  - EBRD's Environmental & Social Policy
  - ILO Convention No. 29 (1930) and 105, Forced and Bonded Labor, 1957
  - ILO Convention No. 87, Freedom of Association and Right to Organize, 1948
  - ILO Convention No. 98, Right to Organize and Collective Bargaining, 1949
  - ILO Convention No. 100, Equal Remuneration, 1951
  - ILO Convention No. 103, Maternity Protection Conventions, 1952
  - ILO Convention No. 111, Discrimination in Respect of Employment and Occupation, 1958
  - ILO Convention No. 138, Minimum Age, 1973
  - ILO Convention No. 155, Occupational Safety and Health, 1981
  - ILO Convention No. 159, Vocational Rehabilitation and Employment (Disabled Persons)), 1983
  - ILO Convention No. 182, Worst Forms of Child Labor, 1999
  - ILO Convention No. 190, Violence and Harassment, 2019
- **Applicable Mongolian Laws and Standards as foloows:**
  - The Contractor is subject to specifically complying with following laws, regulations, and standards.
  - Constitution of Mongolia (1993)
  - Mongolian Law on Labor (2021)
  - Mongolian Civil Code (2002)
  - Mongolian Law on Promoting Gender Equality (2011)
  - Mongolian Law on Minimum Wage (2010)
  - Mongolian Law on Combating Human Trafficking (2012)
  - Mongolian Law on the Protection of the Rights of the Child (2016)
  - Mongolian Law on Social Protection of Disabled Persons (2016)
  - Mongolian Law on Promoting Employment (2011)
  - Mongolian Law on National Human Rights Commission (2020)
  - Mongolian Law on Sending Labor Force Abroad and Receiving Labor Force and Specialists
  - from abroad (2001)
  - Law on Personal confidentiality (1995)
  - Law on supporting Small and Medium Enterprises (2019)
  - Law on Information transparency and individual's rights to information (2011)

Key Roles & responsibilities for Management Plan Implementation

№	Position	Key Roles in a Project Organization Chart
1	Project Manager	• Overall decision making and project management. • Participate in the Grievance Redress Mechanism (GRM) Committee for all types of grievances, including those related to Trafficking in Persons, Sexual Harassment, and Gender-Based Violence, as needed. • Engage in the GRM Committee in cases involving complaints against the Project Manager. • Provide guidance and support to facilitate collaboration with government bodies and other authorized organizations. • Provide overall guidance and support for the effective implementation of the Project's LMP

[157] Urban Planning and Research Institute, 2025. Feasibility Study of the Ulaanbaatar Public Transport (Light Rail Transit-LRT) Project from the General Archives to Sukhbaatar Square: General Section, Ulaanbaatar City, Page 20

№	Position	Key Roles in a Project Organization Chart
		● Ensure adequate resources are allocated to support approved human resource management activities. ● Coordinate with the Engineering Team on matters related to human resource management. ● Review proposals and approve resource allocation to ensure practical and efficient utilization. ● Confirm that specific LMP procedures are established and in place for all site-related activities.
2	Deputy Project Manager	● Overall project policy and monitoring relations with consultant and clients team. ● Conducting daily/ weekly meeting all staff /subcontractors to point out the difficulties in work activities, requirement of resources, order/ direct material and equipment at site with maximum efficiency, find solutions and taking immediate actions. ● Review correspondence for proper action. ● Coordination the communication with key stakeholders. ● Implement risk management strategies and prepare contingency plans.
3	Environmental and social specialist	● Development of CESMP ● Implement measures to mitigate all potential negative impacts, in alignment with the objectives outlined in the LMP ● Ensure all staff and workers are fully informed about the LMP procedures and clearly understand their roles and responsibilities. ● Participate in the workforce recruitment process in coordination with local government authorities and non-governmental organizations. ● Deliver regular training and facilitation sessions for employees and subcontractors on social requirements, in accordance with the training plan, and monitor compliance with relevant standards.
4	Environmental specialist	● Support and participate in the investigation of reported incidents and grievances, including those related to labor relations and breaches of the Code of Conduct ● Deliver regular training and facilitation sessions for employees and subcontractors, in accordance with the training plan, and monitor compliance with relevant standards.
5	Social specialist	● Development of Social management plan as part of CESMP ● Ensure that all staff and workers are aware of the procedures and understand their specific roles and responsibilities as outlined in the LMP ● Actively participate in the recruitment process by collaborating with local government bodies and non-governmental organizations. ● Inform local communities about procurement and employment opportunities related to the project. ● Support the coordination and implementation of internship and apprenticeship programs at the project site. ● Assist in the delivery of vocational training programs to enhance workforce skills. ● Maintain a comprehensive site diary or record-book documenting all relevant matters related to social issues management, incidents, emergencies, inspections, and monitoring activities. ● Ensure that labor management records and documentation are regularly updated, track progress, and enforce improvements to enhance performance quality. ● Introduce and inform all the workers on the Grievance Redress Mechanism ● Inform received complaints to relevant teams. ● Monitoring any grievance resolutions to ensure they are implemented and completed on time. ● Provide information about the grievance mechanism to Stakeholders and organize an activity to introduce the procedure. ● Submit Grievance Redressal Report to Engineer and PIU.

№	Position	Key Roles in a Project Organization Chart
6	*Human Resource Department*	● To review and evaluate the progress of the LMP implementation ● Manage the workforce recruitment and selection process ● To conclude the employment contract with the workers ● Participate in GRM committee on all types of grievance

Mitigation measures

Overview of the Labor management risks opportunities and mitigation measures: The Contractor is responsible for implementing all procedures and measures outlined in the Labor Management Plan, including, but not limited to, monitoring staff performance, taking timely corrective actions, and reporting on implementation progress and corrective measures to both the Engineer and the Client. The Labor Management Plan will comprehensively govern all labor-related issues concerning the Contractor's personnel, as well as the personnel of Subcontractors, in accordance with the General Conditions of the Contract.

This section aims to outline activities that mitigate risks and enhance opportunities throughout the project lifecycle. It addresses potential risks by detailing preventive procedures against labor law violations, forced labor, and discrimination, while also establishing reliable monitoring mechanisms to evaluate performance. Since labor relations impacts during the pre-construction phase are minimal, these impacts are summarized and categorized below, along with corresponding mitigation measures aligned with applicable legal requirements.

The contractor will aim to reduce the unemployment rate of the defined project-affected area. Offering recruitment from residents, it can aid in increasing the income level and the overall standard of living. The following measures will be implemented to enhance local and regional employment opportunities:

- The Contractor shall use a number of channels in the publishing of vacancies (listing the required qualifications for all categories of employment) within the project-affected areas.
- Cooperate with local government
- Disaggregate applicant data by gender, resident status, latest attainment of education, and the type of position, to develop a better-targeted training program
- To implement a Labor Management Plan defining the strategy and commitments of the contractor to encourage the employment of qualified individuals among the local population in the project.

Pre-construction phase	
Risks	**Mitigation measures**
Labor conflicts and/or non-compliance with the applicable law and standards	Establishing human resource policy and procedures on labor force management, code of conduct, recruitment procedures, etc. Define the terms and conditions of work hours, pay, labor agreement, etc.
Opportunities:	**Proposed enhancing measures**
Provide employment opportunities for local citizens	● Establish an equal and transparent recruitment and selection strategy ● Dissemination of job postings shall be developed to outreach potential local candidates. ● Establish close working relationship with the local authority ● Prioritize the hiring of the local citizens for the temporary construction works
Construction phase	
Risks	**Mitigation measures**
Workplace discrimination	● Conduct training and awareness sessions on anti-discrimination policies, incorporating relevant national legislation and international standards ● Establish and promote the use of an internal grievance redress mechanism specifically for workers. ● Partner with non-governmental organizations (NGOs) to receive expert

	guidance, facilitate training, and address workplace discrimination issues. ● ensuring equal opportunity and fair treatment in recruitment, employee status, compensation (including wages and benefits), working conditions, terms of employment, ● Provide access to training and promotion, termination or retirement processes, and disciplinary actions. ● Deliver induction training that covers workplace discrimination, relevant legal obligations, and contractual responsibilities. ● Provide training to employees, subcontractors, and suppliers on ILO conventions and protocols related to forced labor, child labor, freedom of association, non- discrimination, and equal opportunities. This should include information on how to identify and address potential violations. ● Establish grievance mechanisms that allow employees, contractors, and suppliers to raise concerns related to forced labor, child labor, freedom of association, non-discrimination, and equal opportunities. The grievance mechanisms should be accessible, confidential, and independent.
Child labor	● Conduct training and awareness sessions on zero-tolerance policies, incorporating relevant national legislation and international standards ● To collect employees' data disaggregated by age and conduct daily site inspections for the enforcement of the minimum age of 18 ● Incorporate the terms on zero-tolerance policy on child labor into the employment contract ● Develop and implement a policy that explicitly states the company's commitment to compliance with ILO conventions and protocols related to forced labor, child labor, freedom of association, non-discrimination, and equal opportunities. The policy should be communicated to all employees, subcontractors, and sub-suppliers. ● Conduct regular risk assessments to identify any potential risks related to forced labor, child labor, freedom of association, non-discrimination, and equal opportunities. The risk assessment should be carried out across the company's supply chain, including suppliers and subcontractors.
Forced Labor	● Conduct training and awareness sessions on zero-tolerance policies, incorporating relevant national legislation and international standards ● Incorporate the terms on zero-tolerance policy on forced Labor into the employment contract ● Ensure that each worker has a written and signed employment contract. ● Develop and implement a policy that explicitly states the company's commitment to compliance with ILO conventions and protocols related to forced labor, child labor, freedom of association, non-discrimination, and equal opportunities. The policy should be communicated to all employees, subcontractors, and sub-suppliers. ● Conduct regular risk assessments to identify any potential risks related to forced labor, child labor, freedom of association, non-discrimination, and equal opportunities. The risk assessment should be carried out across the company's supply chain, including suppliers and subcontractors.
Poor working conditions	● Ensure that workers have appropriate working conditions, sanitation facilities separate for male and female, basic amenities
Opportunities:	**Proposed enhancing measures**
Local employment Market opportunities for local community members and revenue of local business will be increased.	● Develop a formal recruitment strategy aimed at promoting the employment of qualified individuals from the local community. ● Prepare an employment forecast to identify and plan for the availability of skilled local candidates. ● Organize local job fairs to directly engage with potential candidates from surrounding communities ● Prioritize the hiring of the local citizens for the temporary construction works
Managing labor force	● Design and implement a comprehensive training program to raise awareness and build the capacity of employees in identifying, preventing, and addressing potential social risks. ● Develop and deliver training and information sessions on relevant labor laws and workers' rights, aligned with Mongolian legislation and applicable international standards.

Management of worker relationship

Workforce forecasting

There are two main categories of employees:

- Permanent Employees: represent the Project personnel who have indefinite employment appointments.
- Temporary Employees (or Contractors): represent members of the workforce who are hired for a specified term for a particular task assignment.

Sub-Contractors are required to document whether available positions are for the full period of the contractor's deployment with the Project or are temporary appointments, and to indicate the duration of each employment contract.

Human resource Policies

The Contractor established documented human resources (HR) policies, which will articulate the Contractor's approach to workforce management in compliance with the requirements of EBRD's Performance Requirement (PR) and relevant national labor laws. All policies and procedures are readily accessible, and communicated to all workers in the primary language(s) spoken by the workforce to ensure full understanding and transparency.

Recruitment

The Contractor is committed to employing a fair and equal recruitment and selection process, in compliance with Mongolian Law, legislation, Client's requirement, and company regulations. The job postings of temporary job opportunities will be published at the Governor's office and related social media and websites to attract the local population. The Contractor will develop a clear job description to guide the selection procedure, this will include the detailed responsibilities, skills and qualifications etc. The Contractor will not recruit anyone below the age 18, according to the zero-tolerance policy.

Working Relationships

The Contractor has established and implemented procedures to ensure that all workers are provided with written employment contracts at the commencement of their employment. These contracts clearly define the nature of the employment relationship with the Contractor and outline workers' rights in accordance with national labor laws and any applicable collective bargaining agreements. This includes entitlements such as wages, working hours, rest periods, overtime arrangements and compensation, as well as statutory benefits such as sick leave, maternity/paternity leave, and annual holidays. All material changes to employment terms are formally documented and communicated to workers in a timely manner. The information is presented in a format that is both understandable and accessible, using the main language(s) spoken by the workforce. The Contractor's human resources management system maintains accurate and up-to-date employment records, while ensuring full compliance with worker privacy and data protection requirements.

The Contractor is required to finalize and sign employment contracts with all employees before they commence work or enter the project site. Similarly, all Subcontractors must establish formal employment relationships by concluding contracts with their respective workers prior to the start of employment.

Employment contracts are prepared in a language that the employee fully understands. These contracts must be issued before the commencement of work and must include all initially advertised terms, including compensation packages and any additional relevant information.

The length of assignment for each temporary position must be specified so that candidates are fully aware that the appointments are not permanent. This is particularly important for people in the local communities who may not have had previous experience with waged or temporary employment and may assume that all jobs will be permanent. Specific efforts shall be made to ensure proper understanding of the written provisions in contracts, with specific verbal explanations delivered individually in a simple and understandable manner to avoid any confusion with respect to the duration and terms of employment.

The Contractor has established a communication process that ensures workers receive timely and adequate information about any changes that may affect them, particularly those related to ongoing or anticipated developments within the project. Workers are also provided with opportunities to offer feedback as part of the Contractor's commitment to continuous improvement. This includes clear guidance on how to submit concerns or complaints through the established Grievance Redress Mechanism, in line with the requirements set out in Paragraph 21 of this Performance Requirement.

- **Labor Remuneration**
    - All wages and salaries paid to employees and Contractors must accord with the HR policies of the Contractor.
    - All employees will be guaranteed the minimum wage regardless of the skill level.
    - All employees must be provided with an employment contract that clearly sets out their salary conditions and other allowances.
    - Employees (local or regional workers) will be provided a competitive salary in relation to market rates.
- ***Termination and Redundancy***
    - All worker terminations will be performed strictly according to Mongolian legal requirements and HR policies. The contractor will establish procedures to guide the redundancy of employees and to deal with unforeseen events during operations. Key elements will include:

    - at the time of hiring, the period of employment and the conditions for hiring and layoff will be clearly explained to new recruits and recorded in individual employment contracts;
    - during regular meetings held with worker representatives, personnel management will share information on the Project's schedule and potential layoffs (particularly for temporary construction jobs);
    - the Project intends to avoid Collective Redundancies (as defined in EBRD PR2); Redundancy does not include the planned cessation of temporary employment, such as the demobilisation of contractor workers at the end of their assignment.

Collective Redundancies

Collective Redundancies are defined as follows (EBRD - PR2, referring to Article 1 of EU Directive 98/59): "dismissals affected by an employer for one or more reasons not related to the individual workers concerned where the number of redundancies is, over a period of 30 days In the event that Collective Redundancies as defined above cannot be avoided, they will be managed as follows (these requirements apply to both Contractor or its' Subcontractors):

- 30 days' notice of redundancy will be given.
- Consultation will be made with trade unions or workers' representatives (where there are no trade unions) on amounts of severance pay.
- Severance will be paid in the amount of: either one month's base pay as a minimum, or the amounts agreed in consultation with unions or workers' representatives.

- Selection criteria for those to be retrenched will be transparent and may be based on the following:
    - length of service;
    - skills assessment;
    - disciplinary record;
    - performance record;
    - absence record;
    - knowledge

Worker Houses, Work Rotations and Transportation

The contractor temporary facilities during construction will be built in line with the Construction Norm (BnBD).

Management of Subcontractors and Third parties

The Contractor shall ensure that all subcontractors engaged in the project fully comply with the requirements outlined in the Labor Management Plan (LMP), the Contractor's Environmental and Social Management Plan (CESMP), Code of Conduct, and all applicable national labor laws and international standards, including ILO Conventions and the EBRD Environmental and Social Policy.

Subcontractors are required to:

- Implement fair and transparent recruitment and employment practices.
- Prohibit the use of forced labor, child labor, and any form of discrimination, harassment, or gender-based violence (GBV).
- Adhere to occupational health and safety (OHS) standards applicable to the construction industry
- Participate in mandatory training programs organized by the Contractor, covering topics such as grievance mechanisms, workplace safety, child labor, gender equality, and zero tolerance against GBV and TIP (Trafficking in Persons).
- Establish internal grievance handling procedures aligned with the Contractor's GRM or ensure access to the Contractor's grievance mechanism if they do not have their own.

Subcontractor obligations will be formally included in all contractual agreements through clear terms and conditions. These agreements will specify adherence to labor standards, grievance handling, reporting obligations, and non-compliance consequences.

The Contractor will apply the following measures to manage and monitor subcontractor compliance:

- **Prequalification and Due Diligence:** Subcontractors will undergo a screening process before contract award, including verification of legal compliance, labor standards, and EHS records.
- **Contractual Conditions:** All contracts will embed binding environmental and social clauses, including compliance with the LMP, CESMP, and grievance procedures
- **Orientation and Training:** Subcontractors' employees will be inducted into project labor policies and provided with ongoing training to ensure awareness and compliance.
- **Regular Monitoring and Audits:** The Contractor will conduct periodic site inspections, worker interviews, and documentation reviews to assess subcontractor compliance.
- **Corrective Action Requirements:** If non-compliance is detected, the Contractor will require the subcontractor to immediately implement corrective measures. Persistent non-compliance may result in contract suspension or termination.

All subcontractors must sign a Letter of Acknowledgement affirming their understanding of and commitment to the Contractor's labor standards, grievance mechanisms, and zero-tolerance policies. Failure to comply with these standards will lead to contractual penalties, including possible disqualification from future project activities.

By implementing these measures, the Contractor ensures that labor management standards are maintained consistently across all project worksites, promoting fair labor practices and safeguarding workers' rights throughout the supply chain.

Induction Training

The Contractor is responsible for organizing and funding induction training for all employees prior to granting them access to the project site. This mandatory training will introduce workers to key site procedures, including the Code of Conduct, environmental protection, health and safety protocols, general site rules and regulations, and social policies.

The induction training plays a vital role in shaping employee attitudes, fostering a culture of safety, and ensuring a clear understanding of the company's expectations. It also provides an opportunity for workers to become familiar with safe work practices and their responsibilities.

All employees must provide written acknowledgment of their understanding and acceptance of the site rules and policies before beginning work on the project.

A comprehensive Contractor Training Plan will be submitted separately, outlining the full scope of training activities. For further details, please refer to the Training Plan.

All staff and Subcontractor employees will undergo induction training where they are made familiar with the Company Policies and Procedures, the relevant national legislation and international regulations. This will include but not limited to: general induction on Occupational health and safety,

In order to prevent such incidents from occurring in the construction sites, here are some measures that we are proposing to prevent gender-based violence and harassment:

- Training: The company should provide regular training to all employees, including managers and supervisors, on what constitutes gender-based violence and harassment, how to identify it, and what to do if an incident occurs;
- Posters and Signs: Display posters and signs in the workplace that promote a respectful and harassment-free environment, and include information on how to report incidents of harassment or violence.
- Reporting Mechanisms: The company will have multiple reporting mechanisms in place, such as, email addresses, and in-person reporting options, to make it easy for employees to report incidents of harassment or violence.
- Involvement of NGO/Other Specialised Organisation: If an incident occurs, involve an NGO or other specialised organisation to help investigate incidents of harassment or violence, especially if there is a need for confidentiality or sensitivity.
- Confidentiality: It is essential to maintain confidentiality throughout the investigation process to protect the victim's privacy and ensure that the investigation is conducted fairly.
- Support for Victims: The company will have a support system in place to aid victims of gender- based violence and harassment, including access to counselling services, medical treatment, and legal assistance.

Mitigation measures for the labor risks and Enhancement of opportunities

Child Labor: The Contractor has ensured full compliance with all applicable national legislation and international labor standards concerning the employment of minors, upholding the standard that provides the highest level of protection for children. Employment practices explicitly prohibit the engagement of children in any form of labor that is economically exploitative, hazardous, detrimental to their education, or harmful to their health, safety, or overall development—physically, mentally, morally, or socially. All individuals under the age of 18 that are identified at the project site will be removed and will not be allowed to perform any work.

Provide training to employees, subcontractors, and suppliers on ILO conventions and protocols related to forced labor, child labor, freedom of association, non- discrimination, and equal opportunities. This should include information on how to identify and address potential violations.

Forced Labor: The Contractor has strictly prohibited the use of any form of forced or compulsory labor in the execution of its operations. All employment is based on the free will of the worker, and no work is carried out under coercion, threats, or penalties. The Contractor also actively prevents and monitors against abusive or deceptive recruitment practices. This prohibition extends to all types of involuntary labor and any practices associated with trafficking in persons.

Non-Discrimination and Equal Opportunity: The Contractor maintains a non-discriminatory work environment and complies with all applicable national and international standards relating to equal opportunity and fair treatment in employment. Employment decisions are made solely based on job-related criteria and do not discriminate based on personal characteristics such as gender, race, ethnicity, nationality, union affiliation, political opinion, religion or belief, marital or family status, age, disability, sexual orientation, or gender identity.

The employment relationship is guided by the principles of inclusivity, fairness, and respect for diversity. This commitment covers all aspects of employment, including recruitment, hiring, job assignments, compensation (wages and benefits), training, promotions, disciplinary actions, contract termination, and retirement. Gender-based violence and harassment are serious issues in the workplace, and zero-tolerance policy towards gender-based violence and harassment, and ensures that all employees are aware of the consequences of engaging in such behavior.

All employees are treated fairly, with dignity and respect, and have equal employment opportunities.

Open door policy both in office and at the project site that provides employees with an authorised process for raising concerns to senior management, covering any issues that are work related, that affects an employee or contractor, or that an employee deems unfair. Such concerns

may relate (but are not limited) to the following:

- the decision of a manager;
- the behaviour of another employee, manager, or contractor;
- the application of a company policy.

All issues raised by employees under the Open door policy are treated earnestly, impartially, respectfully, and confidentially. Employees are kept appraised of the progress of the grievance and the process ensures strict timeframes for resolution. Employees are informed of the Open door policy at their induction.

Internal Grievance Redress Mechanism

The Contractor has established an internal Grievance Redress Mechanism (GRM) aimed at addressing and resolving complaints raised by project workers in a timely, fair, and efficient manner that seeks to achieve mutually satisfactory outcomes. All personnel employed by the Contractor or its subcontractors have the right to report legitimate workplace concerns in accordance with the respective internal human resources policies. Workers are informed about the internal GRM during the hiring process and induction training, and the mechanism is made easily accessible throughout their employment. The full GRM document can be accessed.

In cases where grievances are deemed unrelated to the Project's operations, they will be respectfully referred to the relevant local authorities or government agencies for further action. Such grievances will be documented in the grievance log as 'Referred and Closed,' with the

complainant informed accordingly. This ensures that all grievances are acknowledged while maintaining the project's responsibility boundaries."

According to the Labor Law of Mongolia, organizations with **20 or more employees** are required to establish a part-time Labour Dispute SC. This commission is tasked with managing the conciliation process for individual labor rights disputes. The LDSC serves as the first-instance body for resolving individual labor rights disputes, aiming to address issues internally before escalating to external legal avenues. The contractor must have established such committee with HR officer, department heads, senior management as well as representatives of the employees.

Non-Compliance measures

The Contractor ensures that all disciplinary actions are handled fairly, transparently, and in line with due process. Employees are given the opportunity to respond to allegations before any formal action is taken. Minor issues are generally addressed informally through private discussions with the responsible manager, while more serious matters follow a structured disciplinary procedure.This procedure includes four progressive stages:

1. **Oral Warning** – Issued for initial minor misconduct or performance concerns.
2. **Written Warning** – Given if issues persist or for more serious offenses, detailing expectations and consequences.
3. **Final Written Warning** – Applied if misconduct continues or in cases of serious breaches not warranting dismissal.
4. **Dismissal** – Enforced if there is no improvement after previous warnings. Only a senior manager can authorize dismissal, with reasons provided in writing.

In cases of **gross misconduct**, the employee may be suspended on full pay pending investigation. Suspension is typically limited to five working days, during which the employee may not contact colleagues or stakeholders without consent. Gross misconduct includes, but is not limited to: theft, fraud, bribery, data breaches, assault, substance abuse, serious safety violations, harassment, discrimination, and trafficking in persons. The Contractor enforces a zero-tolerance policy and treats such complaints as potential criminal offenses alongside its internal grievance procedures.

If gross misconduct is confirmed after a full investigation, it will normally lead to **summary dismissal**—termination without notice or severance pay. This policy is designed to protect workplace integrity, uphold safety and professional standards, and ensure that all actions are compliant with internal regulations and applicable labor laws.

Monitoring and Reporting

Overview of Monitoring Requirements

The frequency of the monitoring report with the corrective action plan for the problem areas will be agreed with the PIU. The monitoring plan is structured by the three phases (pre-construction, construction, post-construction operation) and consists of environmental indicators, sampling locations. Monitoring will address:

- Any significant environmental and social risks and impacts identified during the environmental and social assessment process;
- Relevant parts of the PRs as identified during project assessment process and subsequent monitoring;
- Actions specified in the ESMP or ESAP;
- Grievances received from workers and external stakeholders, and how they were resolved;
- Any regulatory monitoring and reporting requirements; and

- Any monitoring and reporting required by other parties (for example, off-takers, financiers, certification bodies).

Key Performance Indicators

To ensure compliance with ILO conventions and protocols on forced labor, child labor, freedom of association, non-discrimination, and equal opportunities, the Contractor will take the following steps:

KPI	Target
Development and Revision of the Contractor's Labor Management Plan	Document approval
Include additional Social related requirements in the Employment Contract	Document review
Development of Zero-tolerance policy on SH, CL and Discrimination	Policy developed and approved
Advertising job positions of the through the local government information board, social media, labor office, and other sources	Post all vacancies through these sources
All employees to attend induction training prior to work on site and their participation to be documented	100% participation rate
Develop and maintain Sexual harassment and child labor awareness posters on the Construction site and near Grievance boxes	2 Posters placed
Recruitment of local employment	50% of workers
Signing employment contract	100%
Implementation of Internal Grievance Mechanism	100% resolution rate
Record all of the employee information on the employee ledger with all relevant information	100%

Appendix E: Generic Stakeholder Engagement Plan

Objective and Scope

The Stakeholder Engagement Plan (SEP) provides overall management of the engagement and consultation activities with project stakeholders in the implementation of the project. To ensure effective and result-oriented cooperation with project stakeholders, the Contractor will communicate to inform the project-affected people, public organizations at the local level, and other stakeholders about the project's gender and social inclusion (GSI) requirements and environmental management and related planned activities. The SEP describes direct and indirect stakeholders and their participation and roles in the project implementation based on the impact level of the project activities.

The Contractor has established a sustained relationship with affected Indigenous communities since the early planning stages and has conducted meaningful consultations in accordance with PR 10. Communities actively participated in the design of project activities and mitigation measures, with consultations conducted in a gender-inclusive, multigenerational, and culturally appropriate manner, acknowledging both community diversity and mixed-population contexts

Legal and policy requirements

The Contractor will ensure compliance with relevant national law and legislation and international standards regarding social inclusion and gender equality, protecting and promoting fundamental rights and principles at work for all employees, and managing the environment. According to EBRD's Performance Requirement 10: Information Disclosure and Stakeholder Engagement, the Contractor includes following requirements in this Plan:

- Stakeholder identification and analysis: as a first step in stakeholder engagement the relevant stakeholders need to be identified.
- Stakeholder engagement plan: defines how stakeholder engagement will take place and the grievance procedures to be implemented. Separate grievance processes should be developed for workers and stakeholders.
- Information disclosure: the information that should be disclosed includes purpose, nature, scale and duration of the Project activities; risks and potential social and environmental impacts; description of the consultation process (ways of public participation, time of public meetings). The information should be provided in a manner that is accessible and culturally appropriate.
- Meaningful consultation: where the stakeholders are subjected to significant risks a process of meaningful consultation should be undertaken. The stakeholders should be provided with an opportunity to express their views.
- On-going consultation: public consultation is an on-going process and should continue throughout construction and operational phases.
- Grievance mechanism: the grievance mechanism or procedure should address concerns promptly and effectively. Grievance mechanisms for workers should be developed separately from grievance mechanisms for public.
- Reporting: at least annually public reports on social and environmental performance should be produced.

Based on above mentioned requirements, the Contractor will conduct stakeholder engagement to provide stakeholders with access to timely, relevant, understandable, and accessible information, in a meaningful, effective, inclusive, and culturally appropriate manner and free from manipulation, interference, coercion, intimidation, and retaliation. And stakeholder engagement

will begin as early as possible and will continue throughout the project life cycle. The nature and frequency of stakeholder engagement at all phases of the project development will be proportionate to the nature and scale of the project, its potential adverse environmental or social risks and impact, and the level of stakeholder interest.

The client will comply with the applicable requirements of national law concerning public information and consultation, including those laws implementing Mongolia's obligations under public international law.

In addition, the Contractor will ensure the following recommendations in the stakeholder engagement activities:

General:

- Communicate and cooperate with all stakeholders for successful project implementation.
- Work closely with the office of the bagh and soum level organizations, especially specialists in charge of environmental management.
- Inform the relevant bagh leaders, governors, and local community about the construction activities at all times.
- Disseminate detailed project information through the bagh's social media channels and other preferred information channels.

Environmental management:

- Address residents' safety and waste management properly.
- Dispose of construction waste at appropriate dumpsites, and damages to the road infrastructure should be restored accordingly.
- Ensure rehabilitation and landscaping are carried out accordingly.

Gender and Social Inclusion:

- Clarify the grievance resolving procedure and inform the responsible local officials adequately.
- Ensure engagement of all affected individuals and companies.
- Establish a good relationship with local companies/suppliers to ensure contribution of local support to the project.
- Involve local small and medium-sized enterprises (SMEs) in the catering services for construction workers.

Land acquisition, road and traffic:

- Inform private businesses and project-affected communities of any activities that might disturb their business in advance.
- Consider the operations of the affected businesses during the construction work and carry them out under the work plan.

Summary of stakeholder engagement activities

Stakeholder engagement activities will be carried out with the following aims:

- To inform the local people, leaders, and other stakeholders about the proposed project and its objectives
- To deliver notification letters on construction work commences
- To collect data on project-affected people
- To seek the views, concerns, and opinions of people in the area concerning the project
- To establish if the local people foresee any positive or negative environmental effects from the project, and if so, how they wish the perceived impacts to be addressed.

Identification of stakeholders and communication methods

The key stakeholder groups that may be interested in, and/or affected by the Project, have been identified by the Client with assistance from the Consultant, and provisional methods of communication will be established. The project stakeholders range from the Government organizations in the infrastructure and urban development sector at the local level to residents and local authorities of the expanded and direct project-affected areas.

In the SEP, the Contractor will collaborate and consult with the internal and external, primary and secondary stakeholders to be actively involved in the project, and whose interests may be positively or negatively affected by social and environmental impacts within the project activities. In addition, the Contractor encourages the participation of individuals, groups, or organizations that have an interest in the project and can mobilize resources to affect its outcome. Project stakeholders are categorized and prioritized based on their impact, influence, and power level in the project activities, as shown in Table 1 using an influence-interest matrix. Stakeholders, such as project-affected people and entities, all workers, and the project's internal team, who are adversely affected by potential environmental and social impacts in the project's area, are categorized as high-impact stakeholders as shown in Table 2. They have high interest and influence, thus they are important players in the project. This must be revised by latter.

Table 1 Stakeholder influence and interest matrix

Keep informed	Manage closely
Local mass media channels Districts and Khoroo' social media channels	Project affected person (PAP) Project Affected Entities Offices of Districts and Khoroos
Minimal contacts	**Keep satisfied**
Tobe determined	EBRD The Engineer The Employer

Table 2. Prioritization of the stakeholders

	Affects/ Impact	Influence	Power	Supports or opposes
Primary stakeholders				
PAP	High	High	Low	Supports
Project affected entities	High	High	Low	Support and opposes
Districts and Khoroos	High	High	High	Supports
Governor's offices of Districts and Khoroos	High	High	Medium	Supports
EBRD	High	High	High	Supports
The Engineer	High	High	High	Supports
Secondary stakeholders				
Local mass media channels	Low	Medium	Low	Supports
Districts and Khoroos social media channels	Low	Medium	Low	Supports
Local mass media channels	Low	Low	Low	Supports
Districts and Khoroos social media channels	Low	Low	Low	Supports

Information disclosure

To meet the environmental and social requirements and performance standards of EBRD the Environmental and Social Aspects should be disclosed to the public on a Client's website, other relevant sites such as Districts and Khoroos and on the EBRD's website. Printed copies of the Environmental and Social Aspects will also be made available to the public and other stakeholders at selected locations.

The Stakeholders must receive timely information about planned construction activities, safety measures in the vicinity of the construction site, traffic management, employment and business opportunities and other relevant information through the local media and information boards on project sites. Publicly shared information should also include summaries of annual project progress reports, incorporating environmental and social impacts, health and safety performance and implementation of the external grievance mechanism.

Any public comments or complaints should be reported following the grievance procedure described in **GRIEVANCE MECHANISM** below.

Stakeholders engagement program

The Contractor believes that effective stakeholder engagement is an essential element of project success and mitigating the social and environmental impacts of the Project. In this regard, the Contractor has developed the SEP to guide project staff to perform engagement and consultation strategies. In developing this SEP, the Contractor made specific reference to the Employer, which rests on the following core principles:

- that public information on the project is a right of the local community.
- that a grievance and complaint mechanism will be established; and
- that stakeholder engagement will be ongoing throughout the project's life.
- Inform the Engineer about the stakeholder engagement and consultation activities.
- Engage with stakeholders in their communities.

Because of the nature of social and gender inclusion and environmental management activities, the Contractor's stakeholder engagement program will be implemented in different strategies. For the land acquisition and resettlement issues, the contractor will deliver notification letters to the direct PAPs at least once before construction work commences in 7 days. The contractor will cooperate with the Khoroo's offices to inform PAP in advance.

For the implementation of the project's gender equality and social inclusion requirements, the stakeholders will be involved with the purpose of awareness raising, informing, management and administrative support, collaboration and consultation, and approval. The GSI team will use communication and collaboration means such as in-person meetings, awareness raising training, dissemination of printed materials, local mass media, or social media channels, as well as email communications to achieve its goals. Table 3 and 4 illustrates planned stakeholder engagement strategies. This must be revised by latter.

Table 3 Social Management Stakeholder Engagement Strategy

Stakeholders		Engagement strategy	Communication methods	Content
	Primary stakeholders			
Internal	All employees of the Contractor	Awareness raising	• In-person meetings • Induction and refresher training • Printed materials • Media or social media channels • Email communication	• GSI requirements • Zero tolerance policy • GRM
	All employees of the subcontractors			
	Project management team	Management and administrative support	• In-person meetings • Email communication	• Administrative and management support
External	Project affected people (PAP)	Inform Awareness raising	• In-person meetings • Printed materials • Media or social media channels • Email communication	• Gender and social inclusion requirements • GRM • Safety considerations • Letter of notification • Official letters
	Governor's offices of Districts and Khoroos	Inform Collaboration	• In-person meetings • Printed materials • Email communication • Stakeholder training	• Project GSI requirements • Project construction process • Employment promotion of women and people with disabilities • GRM • Safety considerations

Stakeholders		Engagement strategy	Communication methods	Content
	Governor's Office Engineering Department for Construction	Consultation Collaboration	• In-person meetings • Printed materials • Email communication • Stakeholder training	• Implementation of the CESMP of the infrastructure projects in the construction phase
	PIU	Approval Consultation	• In-person meetings • Email communication	• Implementation of CESMP and sub-plan GSI requirements
	The Engineer			
	Mongolian Gender Equality Center NGO	Consultation Collaboration	• In-person meetings • Email communications • Service agreement	• Training on trafficking in-person Consultancy service for a TIP case
	National Center Against Violence NGO			• Training on sexual harassment • Consultancy service for an SH case

Table 4 Environmental management stakeholder engagement strategy

№	Stakeholders	Form of engagement			Type of participation	Engagement Strategy
		Legal requirement	Planned	Unplanned		
	EXTERNAL STAKEHOLDER					
1	Ministry of Environment and Climate Change (MECC)	Law on EIA			1. Making a General environmental assessment conclusion 2. To discuss the Detailed environmental assessment (DEIA) 3. Approval of the environmental management plan (EMP) 4. Approve the EMP implementation report 5. Make special licenses for chemical substances 6. Others	

№	Stakeholders	Form of engagement			Type of participation	Engagement Strategy
		Legal requirement	Planned	Unplanned		
2	Governor of the Bayan-Undur soum	Law on EIA Article 7.3			The opinion of the governor is taken when drawing up the general environmental assessment conclusion.	
3	Leaders of the public meeting of citizens of Bayan-Undur soum	Law on EIA Article 8.4.8			In the process of developing the DEIA, the local administration and the local people who will be affected by the project are gathered, the report is introduced, the public opinion of the people is taken, and the report is attached to the report.	
4	Citizens of Bayan-Undur soum	Law on EIA Article 8.4.8				
5	Institute of Archeology of the Mongolian Academy of Sciences	Law on Cultural Heritage Article 27.8.	Law on Cultural Heritage Article 38.3		Before carrying out any activity on the land, it is necessary to conduct a relevant study and draw a conclusion from the Institute of Archeology and Paleontology of the Mongolian Academy of Sciences. If cultural heritage is found during the construction work, the work shall be stopped and the soum governor, police, and the relevant authorities (Institute of Archeology and Paleontology ofthe Mongolian Academy of Sciences) shall be notified immediately.	
6	Institute of Paleontology of the Mongolian Academy of Sciences					

The Contractor allocates the required budget for the stakeholder engagement and consultation activities in Table 5. This must be revised by latter.

Table 5 Information sharing activities and resources

№	Planned actions and communication methods	Timeframe	#	Budget
1	In-person meetings - Information sharing and consultation with PAPs and communities	On-going basis, with quarterly consultation for the most affected people throughout the Project duration.	2 times	TBD
2	Public provision of information - email communication and social media channels	Information to be updated online monthly and quarterly, and provided to the governor's office on a semi-annual basis, throughout the project duration	Monthly basis	
3	Dissemination of the project introduction flyer, including GSI requirements and environmental management	Flyer will be available in the baghs, sub-contractors, and stakeholders' offices throughout the Project duration.	100 pcs	TBD
4	Resettlement (Notification letter)	Letters will be delivered to Project project-affected entities. On-going basis, with quarterly consultation for the most affected people throughout the Project duration.	1 time (at least) before construction work commences	

Roles and responsibilities

The generic Contractor's managers and specialists will take key roles and responsibilities for the implementation of the SEP. This must be revised by latter.

Table 6. Roles and responsibilities

№	Role	Responsibility
1	Deputy Project Manager	• Provide overall management and support for the implementation of the Project SEP • Provide sufficient resources to support planned activities • Review budget proposals and approve the allocation of resources for practical and effective use • Provide suitable facilities for project employees in accordance to GSI requirements
2	Assistant Project Manager	• Monitor the implementation, monitoring, and reporting of the SEP • Identify potential stakeholders to be engaged and consulted in the project activities • Maintain effective collaboration with the stakeholders • Manage the information and awareness-raising activities • Take responsibility for the GRMP implementation. • Perform other work necessary for the successful implementation of Project activities.

3	Environment and Social Specialist	• Monitor the implementation, monitoring, and reporting of the SEP • Maintain effective collaboration with the respective stakeholders • Organize information and awareness-raising activities and meetings • Prepare reports with supporting documents • Take responsibility for the GRMP implementation • Perform other work necessary for the successful implementation of Project activities. • Keep informing stakeholders of the project implementation process • Notify PAPs before construction work commences • Makean agreement that confirm the project activity commence and finish date

Grievance mechanism

The objective of a grievance procedure is to ensure that all comments and complaints from any project stakeholder, including residents of nearby communities, contractor employees, contractors' staff, NGOs and other interested parties, are considered and addressed in an appropriate, consistent and timely manner. All grievances will be acknowledged and responded to within a reasonable timeframe.

All comments and complaints associated with the Project should collected and accept. Comments and Complaints Form must be developed. The comments and complaints should be summarized and listed in a Complaints and Comments Log Book, containing the name/group of commenter/complainant, date the comment was received, brief description of issues, information on proposed corrective actions to be implemented (if appropriate), and the date of response sent to the commenter/complainant. Any person or organization may send comments and/or complaints in person or by post, email, or facsimile using the contact information specified in the Form.

All complaints should be responded to either verbally or in writing, in accordance with preferred method of communication specified by the complainant in the Comments and Complaints Form. Comments should be reviewed and taken into account in the Project preparation and implementation; however they may not receive an individual response unless requested.

Individuals who submit their comments or grievances have the right to request that their name is kept confidential.

All grievances will be registered and acknowledged within XX days and responded to within XX days. Grievance log and report on grievance management will kept, as part of annual project progress reports. The grievance management flowchart must be developed.

Monitoring and reporting

Monitoring: To evaluate how the objectives of this SEP are being met, the Contractor will assess progress towards the performance indicators listed above every quarter. In cases where monitoring identifies significant divergence from the terms of this SEP, Contractor management will be notified, and remedial actions taken as necessary.. Table 6 describes the generic key performance indicators of the plan. This must be revised by latter.

Table 7 Key Performance Indicators (This must be revised by latter.**)**

Measures	KPIs	Target number
In person meetings	# of meetings	TBD
Printed materials: flyer, poster, stand, non-technical short report During the construction work	# of types	TBD
Consultation meetings	# of meetings	TBD
Collaboration agreements with expert NGOs	# of service agreements	TBD
Resettlement notification letter	# of letters	TBD

Reporting: To facilitate satisfaction of the commitments set out in this SEP, the Contractor will report back to stakeholders on the outcomes of consultations and justify why decisions and actions have been taken. This disclosure will be public and will also be included in the annual external reporting to the Client. The Contractor will provide monthly updates of activities during implementation of works in the Monthly Progress Reports and annual report to Client for review and approval.

The report will cover the following information :

- Key performance indicators and measures taken for improvement
- Implementation of planned measures and activities
- Observations and concerns raised and/or decisions during meetings.
- Problems encountered concerning social and environmental aspects (including delays, incidents, emergencies, etc.)
- Follow-up on the status of measures and/or corrective actions identified (including remedial measures) and their efficacy, to eliminate and minimize the lack of compliance with contract requirements.
- Stakeholder engagement and consultation activities were carried out during the reporting period, and grievances were registered and resolved.

Table 8 Reporting schedule (This must be revised by latter.**)**

No	Name of Report	Submitted to	Frequency
1	Annual report	PMC, PIU	End of the Project
2	Weekly report		Weekly
3	Report of the training for stakeholders and PAP		Within 5 working days after a training
4	Meeting minutes	Project Manager	Within 5 working days after a meeting

Generic Annex of SEP

CONTACT INFORMATION OF PRIMARY AND SECONDARY STAKEHOLDERS

No.	Stakeholders	Contact information
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		

MEETING MINUTES TEMPLATE

Subject:

Date:

Venue:

Purpose:				
Participants:				
	Total number	Female	Male	Other
Content brief				
Agreed decision				

Prepared by: _____ (name and signature)

Date:

ATTENDANCE SHEET TEMPLATE

Subject:

Date:

Venue:

#	Name	Sex	Name and position	Contacts (Phone number and email)	Signature

BGM Distribution LLC

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