

BAKU METRO EXPANSION PROJECT GREEN LINE

Spoil Disposal Management Plan (SDMP)

Prepared for Baku Metropolitan Closed JSC

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List of Acronyms

AIIB	Asian Infrastructure Investment Bank
BM	Baku Metro (Baku Metropolitan Closed Joint-Stock Company)
BMEP	Baku Metro Expansion Project
BoQ	Bill of Quantities
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CLAMP	Contaminated Land Assessment and Management Plan
CLO	Community Liaison Officer
EHS	Environment, Health and Safety
EPA	United States Environmental Protection Agency
EPB	Earth Pressure Balance
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EU	European Union
GIIP	Good International Industry Practice
GM	Grievance Mechanism
GPS	Global Positioning System
H&S	Health and Safety
HDPE	High-Density Polyethylene
HSE	Health, Safety and Environment
IES	Independent Environmental Specialist
IFC	International Finance Corporation
JSC	Joint-Stock Company
KPI	Key Performance Indicator
LEL	Lower Explosive Limit

LLC	Limited Liability Company
LNAPL	Light Non-Aqueous Phase Liquid
MAC	Maximum Allowable Concentration
MENR	Ministry of Ecology and Natural Resources
MMC	Məhdud Məsuliyyətli Cəmiyyət (Limited Liability Company)
NATM	New Austrian Tunneling Method
PAH	Polycyclic Aromatic Hydrocarbons
PID	Photoionization Detector
PIU	Project Implementation Unit
PPE	Personal Protective Equipment
RSL	Regional Screening Level
SDMP	Spoil Disposal Management Plan
SPS	Safeguard Policy Statement
SR1	Safeguard Requirements 1: Environment
TBM	Tunnel Boring Machine
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbons
VISL	Vapor Intrusion Screening Level
WAC	Waste Acceptance Criteria
WMC	Waste Management Center
WTN	Waste Transfer Note

1. INTRODUCTION

1.1 Project Description

The Government of the Republic of Azerbaijan, through Baku Metropolitan Closed Joint-Stock Company (“Baku Metro” or “BM”), is implementing Phase II of the Baku Metro Expansion Project (“BMEP”), which includes the extension of the Green Line within the urban area of Baku. The Green Line Extension is expected to be financed by the Asian Infrastructure Investment Bank (AIIB) and is being developed in accordance with applicable national legislation, the AIIB Environmental and Social Framework (ESF) 2024 and relevant international good practice.

The Green Line Extension comprises approximately 7.4 km of fully underground alignment and four new underground stations (Y-14, Y-15, Y-16 and Y-17), extending from Khatai to Hazi Aslanov. The alignment is intended to improve east–west connectivity across densely populated residential districts, enhance network resilience, and improve overall operational efficiency. Stations Y-15 and Y-17 include civil structures that were partially constructed during earlier project phases, which will be integrated, upgraded, and completed under the Project.

This Spoil Disposal Management Plan (SDMP) for the Green Line forms part of the Project's Environmental and Social Management Plan (ESMP) and applies to all permanent and temporary works associated with the Green Line Extension. The SDMP covers pre-construction and construction phases and serves as a functional sub-plan to the Contaminated Land Assessment and Management Plan (CLAMP). Project Location is shown in Figure 1



Figure 1: Green Line Extension

1.2 Purpose of This Spoil Disposal Management Plan

This SDMP provides the overarching framework for identifying, assessing, and managing spoil-related risks and impacts associated with the Project. The excavation waste generated along the metro alignment (open cut station and TBM paste) is likely to include contaminated spoil requiring special handling, segregation and licensed disposal rather than routine placement at inert soil-disposal sites.

The excavated soil and dewatered spoil may contain hydrocarbons and/or metals, requiring contamination screening, controlled storage, and disposal via licensed hazardous-waste contractors.

The scope of the plan covers pre-construction and construction phases related to TBM operation, open-cut station excavation, shaft excavations and any other excavations required during construction phase.

The primary objectives of the plan are:

- **Prevent Contamination Release:** To stop the release of contaminants into the environment during construction.
- **Human Health Protection:** To avoid human exposure to contaminants for both the workforce and the surrounding community.
- **Safety Risk Mitigation:** To avoid fire and explosion risks associated with encountering petroleum-contaminated soil and vapors.
- **Regulatory Compliance:** To ensure all works align with Azerbaijan national legislation (such as the Law on Environmental Protection) and international standards (AIIB requirements)

1.3 Financial Resourcing and Cost Allocation

To guarantee the robust and uninterrupted execution of all mitigation, testing, and disposal protocols detailed within this SDMP, specific financial resourcing lines have been structurally allocated within the Project's commercial frameworks.

Implementation costs are partitioned as follows:

Contractor Operational Budget (Bill of Quantities - BoQ): The Main Contractor is contractually required to maintain active, fully funded budget lines under the Environmental, Health, and Safety (EHS) provisions of the contract to cover all immediate site-level controls. This includes the direct procurement of engineering safeguards (e.g., minimum 1.5mm HDPE impermeable liners, weather-proof stockpile coverings), on-site monitoring instrumentation (PIDs and LEL meters), dedicated tankage/concrete pits for semi-liquid TBM paste storage, and the logistical transport of Class B and Class C materials via covered, leak-proof trucks to approved disposal hubs.

Analytical and Laboratory Testing Allowances: Financial provisions for all baseline screening, tactical validation, and mandatory Waste Acceptance Criteria (WAC) / Toxicity Characteristic Leaching Procedure (TCLP) testing will be explicitly budgeted. Sampling costs will be drawn from dedicated third-party analytical laboratory allowances managed under the Supervising Engineer's oversight to preserve auditing independence.

Disposal Fees and Landfill Tariffs: Institutional tipping fees and volumetric disposal tariffs associated with transferring inert spoil to the Tullantıları İdarəetmə Mərkəzi MMC (Waste Management Center LLC, WMC LLC) cell in Sumgait will be secured under dedicated environmental allocation lines overseen by the Baku Metro Project Implementation Unit (PIU).

2. NATIONAL LEGISLATION AND LENDER'S REQUIREMENTS

2.1 Overview

This chapter summarises the applicable national legislative requirements, the Lender's policy requirements, and relevant international good practice that have informed the structure, scope, and implementation approach of this SDMP. Further details on the legal and institutional framework for the Project are provided in Chapter 4 (Legal and Institutional Framework) of the ESIA.

The Contractor and Baku Metro shall comply with all applicable national legal requirements. Where there is a difference between national requirements, the AIIB Environmental and Social Framework (ESF) 2024, and international good practice, the Project shall apply the more stringent requirement.

2.2 National Legislation

The legislation is primarily governed by the Law of the Azerbaijan Republic "On Industrial and Municipal Waste" (No. 514-IQ) and specific resolutions from the Cabinet of Ministers.

The spoil will be managed according to:

- Law No. 514-IQ: The foundational legal requirement.
- Resolution No. 41: The requirement for Hazardous Waste Passports.
- Resolution No. 13: Rules for the inventory and reporting of industrial waste.
- International Standards: US risk-based levels (RSLs)

Azerbaijani law classifies waste into three broad categories based on its origin and risk profile:

- Secondary Raw Materials (will be referred to Class A): Uncontaminated natural geological materials suitable for beneficial reuse W (e.g., clean soil used for backfill or landscaping).
- Safe (Inert) Waste (will be referred to Class B): Waste that does not exert a direct adverse effect on the environment or human health.
- Hazardous Waste (will be referred to Class C): Waste containing explosive, flammable, toxic, infectious, or corrosive substances (ecotoxic).

A unique and mandatory requirement in Azerbaijan is Waste Passportization (Resolution No. 41).

- Every producer of hazardous waste (which would include the Metro contractor in contaminated zones) must create a "Passport."
- Passport document must confirm the waste's hazard degree, chemical composition, and physical properties.
- Contaminated spoil must not legally transported or disposed of without an approved waste passport.

The criteria for acceptance at facilities typically focus on:

- Physical Criteria:
 - No Free Liquids: Landfills in Azerbaijan generally prohibit liquid waste. TBM Paste must be dewatered to pass a "Paint Filter Test" equivalent before disposal.

- Stability: Spoil must be physically stable to prevent landslides within the landfill cells.
- Chemical Criteria: Acceptance is managed by the Ministry of Ecology and Natural Resources (MENR) according to:
 - National MACs: Maximum Allowable Concentrations (usually stricter than US/EU for "clean" soil).
 - WAC (Waste Acceptance Criteria): For the newer hazardous waste cells (constructed with World Bank/EU support), leaching limits (US TCLP or EU WAC) for heavy metals, phenols, and hydrocarbons are used.

The following Spoil Classification Framework is decided to be used a risk-based tier system based on both Azerbaijan legislation and international practice:

- Class A (Inert – Secondary raw material): Below Azerbaijan MACs; suitable for unrestricted reuse.
- Class B (Impacted): Above MACs but below US EPA Industrial RSLs; managed as non-hazardous industrial waste.
- Class C (Hazardous Waste): Above Industrial RSLs, VISLs, or exhibits hazardous characteristics (e.g., flashpoint < 60°C).

2.3 Lender's Requirements

The Project and this SDMP have been developed in accordance with the AIIB Environmental and Social Framework (ESF) 2024. In particular, the SDMP supports compliance with AIIB requirements.

The Contractor and Baku Metro shall implement this SDMP in a manner consistent with AIIB requirements, including monitoring, reporting, and adaptive management as necessary to address changing site conditions, construction methodologies, and operational needs.

The Project and this SDMP have been developed in strict accordance with the AIIB Environmental and Social Framework (ESF, 2024). Specifically, this plan is structured to satisfy the mandates of AIIB Environmental and Social Standard 1 (ESS 1): Environmental and Social Assessment and Management, in particular its Environmental Coverage requirements regarding pollution prevention, resource efficiency, and waste management.

AIIB ESS 1 (Environmental Coverage, Paragraph 38 – Pollution Prevention): Mandates that, during the design, construction, and operation of the Project, the Client apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health, and Safety Guidelines (EHS Guidelines), and minimize and manage waste generation, including through waste reduction and recycling, and the release of hazardous materials.

AIIB ESS 1 (Environmental Coverage, Paragraph 39 – Resource Efficiency): Requires the Project to avoid the generation of hazardous and non-hazardous waste materials, or where avoidance is not feasible, to minimize the generation of such wastes, and to reuse, recycle, or recover effectively managed waste streams, including the use of recycled construction waste where feasible. Where waste cannot be recovered, it must be treated and disposed of using environmentally sound methods. The Contractor shall maintain a transparent chain-of-custody tracking framework (Waste Transfer Notes) to prevent unmanaged or illegal dumping.

In alignment with AIIB expectations, this plan incorporates the technical directives of the **World Bank Group / IFC General EHS Guidelines (2007) – Section 1.6: Waste Management**. The project shall operationalize GIIP waste management protocols through the following tiered implementation controls:

Source Segregation: *Strict physical separation of hazardous excavated streams (Class C) from non-hazardous impacted fill (Class B) and geogenically clean natural clay units (Class A) directly at the cutting face to prevent volumetric cross-contamination.

On-Site Containment (IFC GL §1.6): Storage of all contaminated materials on engineered, impermeable beds with secondary containment bunding, continuous run-off capture, and protective weather covering to fully eliminate ambient soil and groundwater migration pathways.

Waste Acceptance and Characterization: Application of multi-parameter Waste Acceptance Criteria (WAC) and Toxicity Characteristic Leaching Procedure (TCLP) verification prior to off-site haulage to ensure absolute compatibility with engineered cells at the receiving licensed controlled facility.

In accordance with international lending covenants, the SDMP applies the more stringent requirement where a conflict or discrepancy exists between national Azerbaijani legislation and lender safeguards/GIIP standards. For instance, where national Maximum Allowable Concentrations (MACs) are more restrictive than international risk-based levels for clean soil screening, national thresholds will dictate Class A/B segregation. Conversely, where international guidelines enforce more conservative criteria for leaching toxicity parameters, worker-zone volatile screening thresholds, or stockpile containment specifications (such as the 90-day temporary limit), the international lender standard shall take precedence.

3. ROLES AND RESPONSIBILITIES

3.1 Overview

An integrated approach to spoil disposal management involves a range of stakeholders, including Baku Metro (PIU), the Contractor (and their subcontractors), government ministries, local governorships and municipalities, and members of the public. It also requires robust processes regarding information dissemination, training, roles and responsibilities, management actions, monitoring, control, and corrective actions to ensure continual improvement.

3.2 Key Roles and Responsibilities

The key roles and responsibilities for the implementation of the SDMP for the PIU and contractor during pre-construction and construction are outlined below in Table 1.

Table 1: Key Roles and Responsibilities

Role	Responsibilities
Baku Metro Project Implementation Unit (PIU)	- Responsible for the approval of SDMP, disposal facilities and resources required for its implementation including provision of Accountability in Governance structure, Policy, Systems, Procedures, and Corporate safety culture, - Responsible for overseeing the pre-construction and construction phases of the Project, - Ensure roles and responsibilities are clearly identified and allocated within the PIU, - Ensure reporting to AIIB.
PIU Health and Safety Specialist	Ensure Project compliance with Project standards and other requirements set out in this SDMP.
PIU Environmental Specialist	- Overall responsibility for the elaboration and implementation of the SDMP. - Ensure Project compliance with Project standards and other requirements set out in this SDMP during the pre-construction and construction stages. - Development, monitoring and revision of the SDMP during the pre-construction and construction stages. - Assurance of the Contractor's preparation and implementation of the SDMP, as outlined in the ESMP. Monitoring of the Contractor's SDMP implementation to ensure that it continues to be suitable and sufficient. - The PIU Environmental Specialist will approve the SDMP prior to construction.
Supervision Contract Manager	- Responsible for supervising the construction Contractor to ensure that recommendations and requirements are met, as set out in the SDMP, - Technical oversight and verification of soil classification reports.
Contractor's Project Manager	Responsible for overseeing the construction of the Project, including planning and delivery. The Contractor's Project Manager will approve the SDMP prior to construction,

Role	Responsibilities
	- Allocate all necessary and required resources to spoil disposal management, - Place Spoil Disposal Management matters high on the agenda of meetings.
Contractor's Health and Safety Manager	Responsible for evaluating the risk associated with spoil disposal incidents and must have appropriate training.
Contractor's H&S Specialist	- To ensure all safety measures are implemented at the site, - To give tool-box training to the personnel every morning, - Report the activities daily to the H&S manager
Contractor's Social Lead/CLO	Social Lead will; - Ensure compliance with this Plan, - Prepare social sections of the monthly reports (report for social requirement and register) which will include information on the implementation of this plan. - Inform, investigate and report community relation incidents, - Ensure community complaints are registered and followed by Project requirements. - Undertake community/social risk assessments for all disposal sites. CLOs will; - Responsible for community safety issues of this Spoil Disposal Management Plan, - Deliver and/or participate in safety awareness training for local children and adults, - Raise community awareness of safety issues through village meetings and classroom lessons, - Meet local communities in advance of significant impact occurring to describe activities and explain risks, - Ensure grievances received are registered and followed up by Project requirements.
Contractor's Environmental Lead	- Responsible for the preparation and implementation of the SDMP, on behalf of the Contractor, prior to and during construction. The SDMP will set out the systems, processes and procedures, resources, roles and responsibilities of the Contractor, and their sub-contractors, in relation to spoil disposal management. - Keeping the environmental records, - Daily implementation of the SDMP, including site screening, segregation, and maintenance of the Contaminated Soil Register, - Conducts real-time monitoring (PID/LEL) and on-site testing (Paint Filter).
Contractor's Environmental Specialist	- To do daily environmental inspections, - Warning people who do not comply with the environmental instructions, - Ensuring to take the environmental precautions at the construction site, - Reporting the activities daily to the Environmental Lead.

Role	Responsibilities
Sub-Contractors	• Subcontractors are bound to apply all procedures and measures specified by Contractor in SDMP and Project Requirements. Contractor will make sure that the subcontractors are working in compliance with the requirements of the SDMP and will be controlling the performance of all Subcontractors with regard to SDMP and project-specific SDMP and procedures. • Contractor will comply and make sure all Subcontractors also comply with National Laws and will also conform to international standards and practices generally prevailing in the industry, including relevant Standards of the Lenders.
Employees	• S/he is responsible for the implementation of the topics covered by the training by participating in the training related to the plan. • Complying with the Spoil Disposal Management Plan/instructions • Following the instructions prepared by the inspectors regarding Spoil Disposal management requirements.

4. SPOIL DISPOSAL MANAGEMENT

The implementation structured to be done according to the following implementation matrix:

Table 2: Implementation Matrix

Phase	Activity	Tools/Standards	Key Responsibility
Before-Construction	Strategic Mapping via CLAMP	Borehole Sampling / MACs TPH, BTEX, PAHs, Heavy Metals, and TCLP/WAC leaching tests.	PIU / Engineer
Excavation	Tactical Screening	PID, LEL, Visual	Contractor / Env. Specialist
Pre-loading	Stability Check	Paint Filter Test	Contractor
Transportation and Disposal	Compliance Check	WAC / TCLP / Passport	Contractor / MENR

4.1 Before Construction (Refer to CLAMP)

Prior to excavation, the alignment is pre-classified based on:

- **Baseline Classification:** Use of US EPA Industrial RSLs, Azerbaijan MACs and WAC / TCLP results. Material will be pre-classified based on Pre-Construction borehole data ('Generator Knowledge') generated via CLAMP.
- **Obtaining Waste Passport:** Mandatory documentation per Resolution No. 41 for all hazardous waste transport. Sampling results will be used for obtaining the waste passport.

4.2 Construction

Management of spoil should be conducted in real-time as material is excavated:

- **On-Site Tactical Screening (excavation)**
 - Continuous PID/LEL Monitoring: Real-time gas screening at the TBM face and shaft heads to detect volatile vapors.
 - Visual/Olfactory Inspection: Constant assessment for oil staining or chemical odors.
 - Paint Filter Test (EPA 9095B): Conducted at the shaft before any batch is loaded into trucks to ensure no free liquids are present. If a sample fails (leaks liquid), that batch cannot be loaded onto a truck for disposal until it is further dewatered or mixed with a drying agent (like lime or fly ash) (common practice globally).
- **Segregation and Storage (Pre-Loading)**
 - Physical Segregation: Contaminated "spoil" must be physically separated from clean spoil according to Spoil Classification Framework.
 - If a sample fails (liquids observed dripping within 5 minutes) Paint Filter Test, the material must be diverted to a Stabilization Pad to be mixed with pozzolanic binders (e.g., lime or cement) until it can pass a re-test).

- Contaminated stockpiles shall be placed on a 1.5mm HDPE impermeable liner. The 1.5 mm HDPE stockpile liner must be protected from mechanical damage and puncture during mucking operations by: (a) installing a high-strength non-woven geotextile underlay (min 300 g/m²) beneath the liner, and (b) placing a protective 300 mm cushion layer of compacted sand or clean soil over the liner prior to stockpiling.
- All collected leachate and stormwater runoff from Class B/C stockpiles must be classified as Class C (Hazardous) liquid waste. It must be collected in double-walled chemical storage tanks, daily logged in the Contaminated Soil Register, and transported via licensed vacuum tankers to an approved hazardous wastewater treatment facility. Direct discharge to sewers or environment is strictly prohibited.
- Stockpiling: Class A, B and C must be stored separately and conditions given in the matrix below should be fulfilled:

Table 3: Stockpiling Classes

Feature	Class A (Inert)	Class B/C (Contaminated)
Base Material	Compacted ground	1.5 mm HDPE liner with a high-strength non-woven geotextile underlay (min 300 g/m ²) beneath the liner and a protective 300 mm cushion layer of compacted sand or clean soil over the liner prior to stockpiling.
Covering	Optional (for dust)	Mandatory (Plastic)
Runoff Control	General silt fences	All collected leachate and stormwater runoff from Class B/C stockpiles must be classified as Class C (Hazardous) liquid waste. It must be collected in double-walled chemical storage tanks, daily logged in the Contaminated Soil Register, and transported via licensed vacuum tankers to an approved hazardous wastewater treatment facility. Direct discharge to sewers or environment is strictly prohibited.
Max Storage Time	Unlimited	Max 90 Days (Best Practice)

*This is an international GIIP / Project standard adopted to ensure continuous off-site transport and prevent accumulation. Under Azerbaijani Law No. 514-IQ, temporary storage is bounded by the parameters approved in the mandatory Hazardous Waste Passport per Resolution No. 41 rather than a fixed calendar limit; the more stringent operational rule of 90 days shall apply in this case.

TBM Paste Storage

TBM paste is a semi-liquid waste with very low water content and has different storage requirements than solid spoil:

- Paste Pits/Tanks: Paste must be stored in steel tanks or concrete-lined pits. It is strictly prohibited to store raw paste in unlined earthen pits.

- **Pre-loading**

- Loading Limit: For dewatered TBM paste and wet-matrix spoil, truck loading must be contractually restricted to a maximum of 65% of the vehicle's physical volumetric capacity (or a pre-calculated weight threshold) to prevent axle-load exceedances and completely eliminate the risk of liquid sloshing and spillage onto public roads.
- Approved Routes: All Class C waste is transported in covered, leak-proof trucks to Tullantıları İdarəetmə Mərkəzi MMC (Waste Management Center LLC, WMC LLC).

- **Loading & Disposal Phase (Compliance Verification)**

- Flashpoint Test: If the spoil is very oily, ensure it isn't "Ignitable" during transport.
- All wheel wash facilities located at high-risk shaft heads (Y-15, Y-16) must utilize a closed-loop system featuring automated sediment coagulation, active oil-water separation, and carbon filtration. All settled sludge from the wheel wash pits must be registered and disposed of as Class C hazardous waste, and water must be 100% recycled.

Testing responsibility matrix is given below:

Table 4: Testing Responsibilities

Test Method	Location	Timing	Frequency
PID / LEL Monitoring	On-site	During Excavation	Continuous
Visual / Olfactory	On-site	During Excavation	Every bucket/muck car
Paint Filter Test	On-site	Before Loading	Per 50–100 m ³ (or per TBM paste batch)

Spoil quantities for excavation works has been estimated in Table 5.

Table 5: Assumption of Class-Based Spoil Quantities for Green Line

Activity	Y14 (50% contaminated)	Y15 and switch (100% contaminated)	Y16 (50% contaminated)	Y17 and switch (10% cont.)	Shafts (50% cont.)
Excavation	101,578	136,548	158,259	121,600	32,228
Inert	50,789	0	79,130	109,440	16,114
Class B/C	50,789	136,548	79,130	12,160	16,114
TBM (75% cont.)	369,837				
Inert	92,459				
Class B/C	277,378				
NATM (75% cont.)	26,085				
Inert	6,521				

Activity	Y14 (50% contaminated)	Y15 and switch (100% contaminated)	Y16 (50% contaminated)	Y17 and switch (10% cont.)	Shafts (50% cont.)
Class B/C	19,563				
TOTAL Inert	354,453				
TOTAL Class B/C	591,682				

The total excavation is 946,135 m³. It is estimated that 34,676 m³ of excavated material will be reused as backfill. Therefore, approximately 355,000 m³ inert spoil and 592,000 m³ impacted/hazardous spoil is required to be disposed in disposal site.

Baku Metro has officially approached MENR regarding this matter, requesting the recommendation of a suitable waste landfill for the management of excavation spoil to be generated during project execution.

In the MENR's official response letter, WMC LLC was recommended for the transportation and disposal of both contaminated and inert excavation spoil (Class A, Class B and Class C).

No physical excavation or tunnel boring is permitted until an independent safeguards audit has verified WMC LLC's technical capacity, liner integrity, active leachate treatment systems, and active environmental permits, with the audit report appended to this SDMP.

Estimated truck counts are given in Appendix-A. The disposal site, WMC LLC, relevant licence is given in Chapter 11, Appendix 11-A. The haul routes for disposal are given in Figure 2 **Hata! Başvuru kaynağı bulunamadı.** and Figure 3 **Hata! Başvuru kaynağı bulunamadı..** The map of sensitive receptors flagged, off-peak restrictions, school-zone bans and speed limits are given in the Traffic Management Plan and shall be strictly followed.



Figure 2: Haul Route to the Disposal Site



Figure 3: Return Route From the Disposal Site

Wastewater

NATM Works

In NATM (New Austrian Tunneling Method) tunneling, which will be used in small proportion compared to TBM EPB, water management is of critical importance for tunnel stability. The water management steps from the excavation stage to the permanent inner lining stage are as follows:

- **Probe Drilling and Grouting:** Systematic probe drilling is performed to determine the groundwater conditions ahead of the excavation face. In the event of excessive water ingress, pre-grouting is applied to consolidate the rock mass and cut off the water flow.
- **Face and Perimeter Drainage:** Water encountered during excavation is removed from the tunnel via temporary ditches created at the tunnel invert or by means of pumps.
- **Shotcrete Effect:** The applied shotcrete reduces water seepage through cracks. However, to prevent water pressure from building up behind it, perforated drainage pipes (weepholes) are installed.

Regarding NATM tunnels, groundwater inflow is highly variable, making precise analytical calculations unfeasible. The necessary mitigation measures required by standard NATM engineering practices given above will be implemented dynamically on-site. However, for approximation purposes, a baseline estimation of 0.02 m³/day/metre can be adopted. If NATM advances 5 m/day, this would constitute 0,1 m³/day groundwater discharge.

To mitigate any potential water quality risks stemming from the historical industrial baseline of the Absheron shallow aquifer, all captured infiltration water will be routed through localized on-site sedimentation basins and oil-water separators to comply with Azersu sewer discharge criteria.

Station Excavation Works

The calculation was performed for the most critical station, where the groundwater volume is expected to be around 2.2 m³/day. This volume is anticipated when the excavation reaches the base slab level; therefore, it should be considered as the peak rate.

To mitigate any potential water quality risks stemming from the historical industrial baseline of the Absheron shallow aquifer, all captured infiltration water will be routed through localized on-site sedimentation basins and oil-water separators to comply with Azersu sewer discharge criteria.

5. MONITORING AND REPORTING

5.1 Monitoring

Work-Zone Monitoring: Continuous LEL and PID monitoring at the TBM cutterhead and station excavation formation levels to ensure worker safety.

Environmental Verification: Weekly inspections of temporary spoil stockpiles to ensure liner integrity and the absence of leachate runoff. All results shall be recorded in the Contaminated Soil Register.

5.2 Key Performance Indicators (KPIs)

The performance of the Spoil Disposal Management Plan will be monitored through a set of Key Performance Indicators (KPIs). KPI results will be reviewed regularly by the Environmental Lead and relevant discipline leads and will be used to support corrective actions and periodic review of the SDMP.

Table 6 summarises the key performance indicators (KPIs) and associated key monitoring actions that can be used to assess the progress and effectiveness of proposed mitigation.

Table 6: Key Performance Indicators and Monitoring Measures

No	Monitoring Area	KPI Description	Measurement / Record Source	Acceptance Criteria	Monitoring Frequency	Responsible
1	Waste Register	Percentage of recorded waste types and quantities	Register reports	100% registered	Weekly	Environmental Lead
2	Waste Register	Percentage of completed tests	Test results	100% completed	Weekly	Environmental Lead
3	Waste Recording	Number of recorded waste transportation forms	Waste transportation records	All spoil trucks reported	Weekly	Environmental Lead
4	Environmental Protection	Number of unauthorized or unmitigated contaminated material release incidents to soil, drainage channels, or the urban environment.	Environmental Incident Log & Site Inspection Reports	Zero (0) incidents	Continuous / Reported Weekly	Environmental Lead
5	Disposal Compliance	Number of waste	Disposal Facility	Zero (0) rejections	Weekly	Environmental Lead

No	Monitoring Area	KPI Description	Measurement / Record Source	Acceptance Criteria	Monitoring Frequency	Responsible
		shipments rejected at the gate of the receiving licensed facility due to Waste Acceptance Criteria (WAC) or free liquid exceedances.	Receipts & Gate Log Reports			
6	Community & Social Safeguards	Number of legitimate public or community grievances upheld regarding haul-route traffic disruptions, fugitive dust, or uncovered trucks.	Grievance Mechanism (GM) Log	Zero (0) unresolved grievances beyond the 7-day closure window.	Weekly	Social Lead / CLO
7	Legal & Contractual Compliance	Number of unauthorized or illegal dumping incidents of project excavation spoil by the contractor or subcontractors	Number of unauthorized or illegal dumping incidents of project excavation spoil by the contractor or subcontractors	Zero (0) incidents	Weekly	Environmental Lead
8	Training	Percentage of waste employee receiving waste disposal training	Training attendance records	100% trained	Monthly	Environmental Lead
9	Spoil Storage Area	Covering of spoils	Visual observations	100% covered for hazardous waste	Weekly	Environmental Lead

No	Monitoring Area	KPI Description	Measurement / Record Source	Acceptance Criteria	Monitoring Frequency	Responsible
10	Spoil Storage Area	Integrity of liners	Visual observations	100% covered for hazardous waste	Weekly	Environmental Lead
11	Spoil Storage Area	Condition of liquid spoil stabilisation pit	Visual observations	100% covered for hazardous waste	Weekly	Environmental Lead
12	Spoil Storage Area	Segregation of spoil	Visual observations	100% of physically segregated according to waste class	Weekly	Environmental Lead

5.3 Audit & Assurance Process and Record-Keeping

To ensure that the mitigation measures, waste classification protocols, and tracking systems defined in this SDMP are executed with absolute compliance, a structured multi-tiered audit and assurance schedule is established. The project framework enforces four distinct levels of environmental auditing throughout the construction phase:

Quarterly Internal Environmental Audits (by Contractor):

The Contractor's Environmental Lead shall conduct a comprehensive internal audit every calendar quarter. This audit will verify site-level compliance, check the integrity of temporary stockpile Class B/C liners and covers, audit daily Contaminated Soil Register entries, and calibrate PID/LEL field monitoring instruments.

Quarterly Chain-of-Custody Audits at Disposal Sites (by Contractor/Engineer):

To verify the physical and legal destination of all excavated materials, a targeted chain-of-custody audit shall be executed quarterly. This includes a strict cross-reconciliation between the Contractor's outbound Waste Transfer Notes (WTNs), the GPS truck tracking logs, and the gate-receipt weighbridge records provided by the WMC LLC facility in Sumgait.

Table 7: Quarterly Chain-of-Custody Audit Requirements

Record	Record Holder	Verification Requirement	Frequency	Responsible Party
Outbound Waste Transfer Notes (WTNs)	Contractor	Cross-check against the corresponding GPS tracking logs and WMC LLC gate-receipt and weighbridge records	Quarterly	Contractor / Engineer
GPS truck-tracking logs	Contractor	Cross-check recorded vehicle movements and destinations	Quarterly	Contractor / Engineer

Record	Record Holder	Verification Requirement	Frequency	Responsible Party
		against the corresponding WTNs and WMC LLC records		
Gate-receipt and weighbridge records	WMC LLC	Cross-check received loads against the corresponding WTNs and GPS tracking logs	Quarterly	Contractor / Engineer

Any discrepancy identified during the reconciliation shall be recorded and investigated in accordance with the SDMP audit and non-conformance procedures.

Semi-Annual Environmental Audits (by Supervising Engineer):

The Supervising Engineer's environmental team shall perform a rigorous compliance audit every six (6) months. This audit will review all Contractor internal logs, verify laboratory WAC/TCLP certification frequencies, evaluate the effectiveness of non-conformance corrections, and cross-check the alignment of spoil volumes with the material balances in Table 5.

Annual Independent Environmental Audits (by Lender's IES):

An independent third-party audit shall be conducted annually by the Lender's Independent Environmental Specialist (IES). The IES will evaluate overarching compliance with Environmental and Social Framework (ESF) 2024 mandates, inspect high-risk excavation sectors, and submit formal external monitoring reports to AIIB for public disclosure.

All non-conformances identified across any audit tier shall be logged immediately and assigned a mandatory corrective action window (ranging from 24 hours for acute containment failure to 14 days for administrative log gaps), under the strict oversight of the Supervision Contract Manager.

5.4 Reporting

- **Contaminated Soil Register:** Daily log of volume, PID readings, and disposal location.
- **Waste Transfer Notes (WTNs):** Chain-of-custody documentation for every truckload.
- **Monthly Reports:** Summaries submitted to PIU and lender.

5.5 Review & Revision of SDMP

Contractor will regularly update the SDMP according to the requirements of the changing needs.

SDMP will be reviewed at least every 6 months to meet the new requirements. The following information obtained by progress reports, audits & inspections and compliance monitoring activities will provide input for the review process:

- Results of internal/external audits and inspections
- Evaluation of compliance
- Communication / Complaints
- Key performance indicators
- Changing circumstances, legal requirements, organization, environmental aspects and impacts
- Recommendations for improvement
- The revised plan will be approved by Project Management.

6. TRAINING

Spoil disposal training requirements shall be identified at the outset (e.g. using a Health Safety and Environment (HSE) Training Matrix), before construction works commence, and the matrix and a training plan will be developed to ensure the preparedness of the Contractor's environmental lead, environmental specialists, H&S specialist and employees. Training shall be delivered by a combination of external training organisations competent in the training topic and internally by the Baku Metro's PIU Health and Safety Specialist and Contractor's Health and Safety Manager during the construction.

Training will be used to communicate business continuity and planning to all personnel. An annual training programme will be developed each year. The programme will be realistic to test spoil disposal management plan and procedures.

Induction trainings and job / activity-specific orientations shall cover:

- **Waste Classification:** Classifying spoil according to SDMP.
- **Waste Record:** Recording waste quantities & types and waste transportation forms.
- **Recognition:** Identifying petroleum-stained soil and odours.
- **Instrument Use:** Calibration and operation of PIDs and LEL meters for supervisors.
- **PPE:** Proper use of chemical-resistant gloves and respiratory protection.
- **Emergency Response:** Procedures for encountering 'free product' (LNAPL) or explosive vapor concentrations (>10% LEL).

Appendix-A – Estimated Truck Counts for Excavation Works

Section / Component	Structure Type	Construction Method	Stations		Planned Construction Start Date	Planned Construction Completion Date	Construction Duration (Days)	Total Excavation Volume (m³)	Truck Capacity (m³/trip)*	Number of Trucks	Number of Trucks per Day	Daily Truck Trips	Assumed Working Hours per Day**	Trucks per Hour (veh/hr)	Total Trucks per Hour for the Station	TBM	NATM
Xatai Station Intersection	Crossover / Switch	NATM	Y14	NATM (m³)	1.03.2026	1.10.2026	214	26.085	16	1630	8	15	15	1	5		
Xatai- Y14 Inter Station Link	Twin Bore Tunnel	TBM (EPB)		Station Excavation Volume (m³)	1.03.2026	1.10.2026	214	92.683	16	5793	27	54	15	4			
Y14 Station	Station Structure	Cut & Cover															
Y14 - Y15 Inter Station Link	Twin Bore Tunnel	TBM (EPB)															
Y15 Station	Station Structure	Excavation and support works have been completed	Y15*	Station Excavation Volume (m³)	1.03.2026	1.10.2026	214	120.375	16	7523	35	70	15	5	14	10	20
Between Y15 and Y16 Stations	Emergency Exit Shaft	Cut & Cover		TBM (EPB)-1 (m³)	24.09.2026	31.07.2027	310	86.943	16	5434	18	35	15	2			
				TBM (EPB)-2 (m³)	24.10.2026	30.08.2027	310	86.943	16	5434	18	35	15	2			
Y15 - Y16 Inter Station Link	Twin Bore Tunnel	TBM (EPB)		TBM (EPB)-3 (m³)	11.02.2027	13.01.2028	336	97.976	16	6123	18	36	15	2			
				TBM (EPB)-4(m³)	13.03.2027	12.02.2028	336	97.976	16	6123	18	36	15	2			
Y16 Station	Station Structure	Cut & Cover	Y16	Station Excavation Volume (m³)	1.03.2026	1.10.2026	214	158.259	16	9891	46	92	15	6	6		
Y16 - Y17 Inter Station Link	Twin Bore Tunnel	TBM (EPB)															
Y17 Station	Station Structure	Excavation and support works have been completed	Y17	Station Excavation Volume (m³)	1.03.2026	1.10.2026	214	111.992	16	6999	33	65	15	4	4		

*Note: For dewatered TBM paste and wet-matrix spoil, truck loading must be contractually restricted to a maximum of 65% of the vehicle's physical volumetric capacity (or a pre-calculated weight threshold) to prevent axle-load exceedances and completely eliminate the risk of liquid sloshing and spillage onto public roads.

