South Asia Co-operative Environment Programme (SACEP)

Plastic free Rivers and Seas for South Asia (P171269)

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN OF SACEP HEAD QUARTERS BUILDING

[DECEMBER 2023]

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN OF SACEP HEAD QUARTERS BUILDING.

Stages of Construction	Activity	Environmental and Social Issues / Potential Environmental and Social Impact	Proposed Mitigation Measures or Enhancement Measures	Mitigation Cost (LKR)	Implementation	Regular Monitoring and Supervision	Frequent Monitoring and Averell supervision	Aspects / Parameters to be monitored	Means of monitoring frequency
Pre construction	Arranging labor for construction works	Workers staying in the construction site may create social issues due to the way they communicate, dress, behavior, consuming alcohol, etc. Potential for spreading communicable diseases Grievances could arise during construction. Public may complain about behavior and attitude of workers.	Health conditions will be closely monitored and prevention mechanisms will be in place to avoid spread of communicable disease. Further, there will be an induction session to the laborer's and staff working for the construction of occupational health and safety, policies, codes of conduct and protocols. Organize daily meetings and provide feedback on compliance and awareness programs on communicable disease and implement prevention mechanisms. Required number of proper sanitary facilities will be installed. Appropriate complaint or grievance redress mechanisms will be installed and it will be publicly available for everyone to report gender-based violence, sexual exploitation and abuse and sexual Harassment (SEA/SH). Campaigns, billboards or notice boards with contact information will be made available. Occupational health and safety officers, security personnel, PPE and first aid kits will reduce adverse impact. Barriers, signages, night light, control systems like safe passage and access control will be installed. Adequate and well-ventilated camps / premises, clean eating areas, and separate sleeping / resting areas for male and female workers will be set up	Part of the construction cost	Supplier / Contractor under UNOPS supervision	Engineer and Environmental Specialist of UNOPS	Environment and Social Development Specialist SACEP	Health and safety plan, awareness program material, number of PPE available and used, Grievance Log, suggestions Box, Assignment of security personal and Health and safety officer.	Attendance of workers, Self-health history declaration and medical report if required., Prior to start assign task and every 3 months.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN OF SACEP HEAD QUARTERS BUILDING.

Stages of Construction	Activity	Environmental and Social Issues / Potential Environmental and Social Impact	Proposed Mitigation Measures or Enhancement Measures	Mitigation Cost (LKR)	Implementation	Regular Monitoring and Supervision	Frequent Monitoring and Averell supervision	Aspects / Parameters to be monitored	Means of monitoring frequency
	Site clearing and preparation for construction.	Excess soil residual spoils including debris, Top Soil removal, Soil erosion and sedimentation of nearby drains	All debris, residual spoil material shall be segregated as much as possible and disposed only at locations approved by the Supervising Engineer. The debris and spoil shall be disposed in such a manner that; (i) waterways and drainage paths are not blocked, (ii) the disposed material should not be washed away by runoff and (iii) should not be a nuisance to the public. Material will be stored in a place where it may reduce soil erosion. Appropriate dyke will be constructed around stock piles. There is no important vegetation in the construction site and suitable vegetation could be replaced during the landscaping of the construction site. Minimum 6 inches slope will be maintained to avoid soil erosion.	Part of the construction cost	Construction team under UNOPS supervision	Engineer and Environmental Specialist of UNOPS	Environment and Social Development Specialist SACEP	Areas were nurseries and green zones are established; Tree Cutting Permit (if necessary)	Physical visit and records of every 3 months
	Transportation and Storing Construction materials at site	Impact associated with extraction of local construction material, Traffic congestions due to heavy vehicle movements, Vehicle access will be limited but some nuisance to the public is likely.	Construction material need to be obtained from authorized supplier, Plan material flow and store only immediate requirement and maintain secondary store. Delivery could be planned only during the off-peak hours, Traffic management plan and traffic aid, coordinating with local authority, police, general public and other stakeholder to rerouting of vehicle traffic. Make sure traffic signs and health and safety signs are in place.	Part of the construction cost	Construction team under UNOPS supervision	Engineer and Environmental Specialist of UNOPS	Environment and Social Development Specialist SACE	Stored material, Procurement and logistic plan	Physical visit and records, every 3 months
Construction	Excavation for foundation and preliminary earth works	Excess soil mixed spoil generates, silt and turbid water flows to nearby drains and finally silt is deposited in drains.	Ensure soil is free from hazardous material and securely dispose excess soil. In case of excess soil, it has to be securely disposed to ensure future use and free from contamination. Turbid water should be diverted along a retention pond before discharging to the drains.	Part of the construction cost	Construction team	Engineer and Environmental Specialist of UNOPS	Environment and Social Development Specialist SACE	Soil deposition turbidity level of nearby drains, waste quantity accumulated in site.	Physical visit and records, every 3 months
	Climate Change Vulnerability of Proposed building	Flooding and Drainage issue due to fluctuation of surface runoff level and Ground water table under the extreme climate change scenario	Design of the building has been done taken to account the anticipated sea level and rainfall pattern fluctuation.	Design cost	Design team and UNOPS	Engineer and Environmental Specialist of UNOPS	Environment and Social Development Specialist SACE	Forecasted flood level and Mean Sea level	First design review.

Stages of Construction	Activity	Environmental and Social Issues / Potential Environmental and Social Impact	Proposed Mitigation Measures or Enhancement Measures	Mitigation Cost (LKR)	Implementation	Regular Monitoring and Supervision	Frequent Monitoring and Averell supervision	Aspects / Parameters to be monitored	Means of monitoring frequency
	Dewatering the excavated pits and trenches.	Possible flooding due to discontinuity of channels. Soil property and texture may change due to removal of water. Minerals and soft layers could be washed away. There could be development of cracks in the building close by. Dewatering process can cause sudden decrease in saturated water level of soil due to lowering of ground water table which can cause localized Ground settlement/instability of ground and it may cause damage to the adjacent buildings. During pilling activity, a big quantity of Mixed slurry containing mud and bentonite can be generated.	Reduce contamination and divert water towards existing drainage and ensure hydraulic balance. Apply surface filter to avoid a blockage in the drain. Temporary drainage is required to divert water. It could be 50 mm diameter PVC pipe. Dewatering needs to be undertaken if it is extremely important. Therefore, adequate measures should be adopted to minimize releasing this turbid water slurry into the drains or nearby wetland. suitable retention pond /Silt trap or sediment basin has to be established at site to divert water before releasing to the vicinity. The type of retention structure should be clearly mentioned in ESMP. Portland cement (type 2) could be an option to undertake construction in stagnant water. This may reduce requirement of dewatering.	Part of the construction cost	Construction team under UNPS supervision	Engineer and Environmental Specialist of UNOPS	Environment and Social Development Specialist SACE	Discharged water turbidity, sedimentation level, discharged solid waste quantity.	Physical observation weekly

	Pilling activities for foundation	Oil and hazardous material release, Water quality degradation, Air quality degradation, Noise pollution Pilling activists will generate linear vibration in significant levels and it may cause potential impact on nearby structures and eventually may damage houses and boundary walls of nearby settlements.	This will be piling foundation and the foundation may reach 30 m depth. As dewatering need to ensure continuous removal of bentonite. The dewatering may require treatment and bentonite need to be disposed separately as per the municipality guideline. As it is low acute toxic chemical, simple treatment is adequate. Calculate required oil or hazardous material and forecast the requirement to avoid any accidents. In the event of any accident, area will be isolated and storing in a secured place and bioremediation will be provided. It is also possible to store in a temporary container. Maintain records of any accidents, measures for cleanup and accidents handling, provide training for staff to handle emergency situation and contamination. Prohibit use of equipment and vehicles that emit dark sooty emissions; Construction schedule will be visible to general public. Use of equipment with noise reduction cover, Position noise making equipment away from houses and receptors. Noise level set by World Bank are 55 and 45 dB(A) during daytime and nighttime, respectively. Slurry will be controlled by installing filtrate and it could be reused for the construction purpose. Detailed pre crack survey/Condition survey has been carried out and proposed mitigation measures will be implemented before starting the piling works. The Radius/ periphery going to be surveyed should be determined taking into account the vulnerable settlements like underserved settlements located in the nearby land. The piling contractor should have an authorized waste/ bentonite disposal site which should have a valid EPL or other letter of approval issued by the Central Environment Authority. The copy of EPL should be shared with SACEP-PIU. Pre-crack survey has been conducted for the 80m periphery from the construction site. All susceptible buildings were inspected after first test boring. All buildings located in an 80 m	Part of the construction cost Will be accessed after the construction	Construction team under UNOPS supervision.	Engineer and Environmental Specialist of UNOPS, External vibration monitoring team,	Environment and Social Development Specialist SACE	Physical observation, Instrumental monitoring of Vibration and measuring the expansion of existing cracks Visual inspection, verification of record, number of trainings organized, number of employees certified to handle hazardous material	Regular observation.

			radius will be re-inspected at the end of piling activities and damage caused by the piling activities will be rectified.						
		Light to medium damage to identified constructions, such as the formation of cracks in walls/boundary wall	Pre-crack survey was conducted for the 80 m periphery from the construction site. All susceptible buildings shall be inspected after the first test drilling. All buildings located in an 80 m radius should be re-inspected at the end of piling activities and damage caused by the piling activities should be rectified. The pre and post crack survey and rectification are included in the piling constructor's obligation. The estimated maximum damage is at the rectification value of 83,668 USD (Annex I), and the contractor's all risk insurance (CAR) has a maximum coverage of LKR 30,000,000 (Annex II), the equivalent of USD 93,396 per UN exchange rate on 15 September 2023.	Identified cost will be covered by the contractor and its CAR.	Construction team under UNOPS supervision	Engineer and Environmental Specialist of UNOPS,	Environment and Social Development Specialist SACE	Physical observation and measuring the expansion of existing cracks	Regular Monitoring
		Physical hazards due to collapsing buildings or part of the building	The test piling is scheduled after school hours and during weekends. Possible damages to the building to be rectified by the contractor, immediately Qualified technical firm shall be deployed in site to monitor the Vibration level with respect following parameters frequency of a transverse wave Vertical in Frequency (Hz) Peak in mm/s Longitudinal in Frequency (Hz) Peak in mm/s Means Peak Particle Velocity (PPV-Peak Vector Some in mm/s) and the result should be evaluated vs the ISO and SL standards during the test pilling	Recovery cost of possible damage will be covered by the contractor and its CAR. 300,000, already included in the UNOPS Health and Safety consideration	Construction team under UNOPS supervision	Engineer and Environmental Specialist of UNOPS,	Environment and Social Development Specialist SACE	Physical observation, Frequency and particle velocity	Regular Monitoring

			2nd level risk assessment shall be conducted after drilling the test pile under close monitoring of the impact level at nearby settlement. Qualified Safety officers should be deployed in an impact zone covering 80 m radius to regularly monitor the impact and response of structures under the ground vibration. Qualified technical firm shall be deployed in site to monitor the Vibration level with respect following parameters frequency of a transverse wave Vertical in Frequency (Hz) Peak in mm/s Longitudinal in Frequency (Hz) Peak in mm/s Means Peak Particle Velocity (PPV-Peak Vector Some in mm/s) and the result should be evaluated vs the ISO and SL standards during the test pilling	Identified cost will be covered by the contractor and its CAR	Construction team under UNOPS supervision	Engineer and Environmental Specialist of UNOPS,	Environment and Social Development Specialist SACE	Physical observation and instrumental Monitoring of frequency of a transverse wave Vertical in Frequency (Hz) Peak in mm/s Longitudinal in Frequency (Hz) Peak in mm/s Means Peak Particle Velocity (PPV-Peak Vector Some in mm/s)	Regular Monitoring

Stages of Construction	Activity	Environmental and Social Issues / Potential Environmental and Social Impact	Proposed Mitigation Measures or Enhancement Measures	Mitigation Cost (LKR)	Implementation	Regular Monitoring and Supervision	Frequent Monitoring and Averell supervision	Aspects / Parameters to be monitored	Means of monitoring frequency
			High risk settlement shall be re-assessed based on the vibration level observed at building during the test drilling period.	N/A	Construction team under UNOPS supervision	Engineer and Environmental Specialist of UNOPS,	Environment and Social Development Specialist SACE	Physical Observation, Instrumental monitoring records and Community consultation	Regular Monitoring
			If the 2nd level risk assessment confirms the high-risk level (includes moderate 2) on particular buildings, Temporary accommodation facilities shall be provided to the necessary PAPs until the end of the piling activity, estimated to be two months.	60,000 to be reserved as a provisional sum.	Construction team under UNOPS supervision	Engineer and Environmental Specialist of UNOPS,	Environment and Social Development Specialist SACE	Physical Observation and Community consultation	Regular Monitoring
		Nuisances' vibration and Noise due to the drilling activity	Piling activities shall be scheduled taken in to account the minimum disturbance can happened for the nearby people (special reference on The Rehabilitation Centre For the Communication Impaired) Vibration and noise level shall be minimized by using most appropriate cutting head for the boring machine. If the nuisances or harm full vibration level /resonance is continuedly observed contractor should comply with the engineer's instruction to change the necessary equipment or part of the machineries.	Part of the construction cost	Construction team under UNOPS supervision	Engineer and Environmental Specialist of UNOPS,	Environment and Social Development Specialist SACE	Physical Observation and Community consultation, instrumental measurement during the piling activity	Regular Monitoring
	Lean concrete	Environmental damage due to transportation and use of natural resources and wood, Water quality degradation, Air quality degradation,	Provision of tight tarpaulin cover on delivery trucks to avoid spills and dust emission; and Prohibit burning of all types of wastes generated, Provision of rain water harvesting, Provision of day light control system, Light control based on motion and daylight, Maintain good ventilation, Construct septic tank, drainage system, watering soil at regular interval to reduce dust, Prohibit use of equipment and vehicles that emit dark sooty emissions, temporary storage area needs to be arranged, solid waste should be disposed in a secured manner and burning is prohibited, segregate and isolate hazardous waste from rest of the waste and workers and community.	Part of the construction cost	Construction team under UNOPS supervision	Engineer and Environmental Specialist of UNOPS,	Environment and Social Development Specialist SACE	Material transportation records, quantity of disposal of waste, discharged effluent/ Slurry and exec concreate,	
	Reinforced concrete works for structural elements.	Water quality degradation, Air quality degradation, Generation of waste,	Construct septic tank / sewage treatment plant, drainage system, spray water at regular interval to reduce dust, Reuse construction waste material, Cover material to avoid air blown particles, prohibit use of equipment and vehicles that emit dark sooty emissions, temporary storage area needs to be arranged, solid waste should be disposed in a secured manner and burning is prohibited, Provision of garbage bins. Excess concreates and mixed spoils should be disposed to authorized disposal yard.	Part of the construction cost	Construction team under UNOPS supervision	Engineer and Environmental Specialist of UNOPS,	Environment and Social Development Specialist SACE	Material transportation records, quantity of disposal of waste, discharged effluent/ Slurry and exec concreate,	

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN OF SACEP HEAD QUARTERS BUILDING.

Stages of Construction	Activity	Environmental and Social Issues / Potential Environmental and Social Impact	Proposed Mitigation Measures or Enhancement Measures	Mitigation Cost (LKR)	Implementation	Regular Monitoring and Supervision	Frequent Monitoring and Averell supervision	Aspects / Parameters to be monitored	Means of monitoring frequency
	Brick works, Plastering and Finishing works including installation of necessary plumbing and Electrical accessories in the building	Generation of Solid waste, waste water, Dust and excessive noise,	Construct septic tank / sewage treatment plant, drainage system, watering soil at regular interval to reduce dust, temporary secured storage area needs to be arranged, Solid waste need to be segregated property and ensure secure disposal. Reuse construction waste material. Arrange separate bin for food waste.	Part of the construction cost	Construction team under UNOPS supervision	Engineer and Environmental Specialist of UNOPS,	Environment and Social Development Specialist SACE	Quantity and characterization of waste.	By weekly
	Supply and installation of tiled floors	Generation of mixed waste spoils including excess mortar, tile grout and residual waste, generate noise, waste water	Reduce residual waste by fallowing proper measurements. Use sharp and appropriate machineries for tile cutting, Reuse construction waste material, arrange separate bin for the waste periodically cleaning the bins.	Part of the construction cost	Construction team under UNOPS supervision	Engineer and Environmental Specialist of UNOPS,	Environment and Social Development Specialist SACE	Quantity and characterization of waste.	By weekly
	Paint on interior and exterior walls	Generation of waste, noise, wastewater, hazardous waste generation	Reuse construction waste material, arrange separate bin for food waste, Paint and required solvent needs to be disposed in an encapsulated container. Door and windows will be closed and during the paining. Hazards waste will be collected in a separate bag and disposed securely. Provide proper ventilation and Personal Protective equipment to workers during painting works. OHSAS standard complied Paint will only be used.	Part of the construction cost	Construction team under UNOPS supervision	Engineer and Environmental Specialist of UNOPS,	Environment and Social Development Specialist SACE	Quantity and characterization of waste.	Once in two weeks
	Installation of water supply and drainage system	There will be vibration, dust and noise which will disturb dwellers in the surrounding area.	Working time will be from 06.00 to 18.00 and Maximum Permissible Noise Levels of 65 dB at Boundaries will be maintain. PPE will be used by construction workers and waste, PVC, gums, tapes and etc. will be cleaned immediately / daily to minimize exposure or hazards. Construction schedule will be visible to general public. All construction machineries will be maintained in prime condition. Special drill bits will be used to reduce vibration. Dust will not be going out by installing net (10mm). PM particles will be controlled by enclosing the sites in order to minimize the PM emission.	Part of the construction cost	Construction team under UNOPS supervision	Engineer and Environmental Specialist of UNOPS,	Environment and Social Development Specialist SACE	Physical observation of Vibration and Noise level Noise level (It should be less than 75 dB), Operations schedule	Once in two weeks
	Construction of septic tank	Disturbance to the surface runoff, accumulation of excavated soil in nearest drains. Possibility to contaminate shallow water table	Decide location keeping the adequate distance for nearest water sources and nearby buildings, adopting standard plumbing techniques to prevent potential leakage. Reuse construction waste material, Arrange separate bin for food waste. Fallow the safe	Part of the construction cost	Construction team under UNOPS supervision	Engineer and Environmental Specialist of UNOPS,	Environment and Social Development Specialist SACE	Physical observation	As per the construction schedule.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN OF SACEP HEAD QUARTERS BUILDING.

Stages of Construction	Activity	Environmental and Social Issues / Potential Environmental and Social Impact	Proposed Mitigation Measures or Enhancement Measures	Mitigation Cost (LKR)	Implementation	Regular Monitoring and Supervision	Frequent Monitoring and Averell supervision	Aspects / Parameters to be monitored	Means of monitoring frequency
	Electrical work	There will be vibration, dust and noise which will disturb dwellers in the surrounding area. Some cables may have Brominated Flame Retardants (BFR) which may be avoided during the installation of electricity. Eg: HIPS, ABS, PP and PC-ABS.	Temporary wiring will be reduced and only used for specific purpose. Supply of current will be regulated through introducing specification 12 - 15 windows will be installed to facilitate day light usage. Ensure water is leak proof and divert waste water to a septic tank, Install daylight control system. Simple trench will be set up to facilitate natural filtration.	Part of the construction cost	Construction team under UNOPS supervision	Engineer and Environmental Specialist of UNOPS,	Environment and Social Development Specialist SACE	Physical observation	As per the construction schedule.
	Construction of pavement	Reduce water recharge and facilitate local flooding	Pavement could be designed in a way that does not reduce water recharge significantly. Rain water harvesting system could be installed. Grass paver / paving blocks will be used to minimize water runoff and increase water recharge.	Part of the construction cost	Construction team under UNOPS supervision	Engineer and Environmental Specialist of UNOPS,	Environment and Social Development Specialist SACE	Physical observation	As per the construction schedule.
Operation	Cleaning new SACEP HQ building	Increase in water consumption for cleaning; Generation of wastewater; Potential release of micro-plastics and toxic chemicals and fumes; Generation of solid residues (non-recyclable components) which may need disposal or incineration; Contaminate groundwater and pollution ecosystem	Securely dispose waste, minimize utilization of chemical and ensure adequate ventilation, there could be a septic tank that could accommodate wastewater and sludge could be removed by respective local authority regularly for further treatment and disposal. Solid waste has to be segregated at source. Separate area and color will be dedicated for different types of waste. Toxic chemicals will be encapsulated to avoid contamination and risks.	Part of the construction cost	Construction team under UNOPS supervision	Engineer and Environmental Specialist of UNOPS,	Environment and Social Development Specialist SACE	Physical observation	As per the construction schedule.
	Conference and meeting	Consumption of energy, Generation of waste and untidy environment, waste water generation	Only one wall will be exposed to sunlight. This is 11.5 m glass wall will be installed to facilitate sunlight. Provision of day light control system, Light control based on motion and daylight, maintain good ventilation, Installation of sewage treatment plant, implement proper solid waste management system, Arrange separate bins for readily degradable waste, paper and plastic. Waste disposal should be secured from flooding, scavengers and rain. It has to be disposed in a secured manner and burning is prohibited.	SACEP operational Budget	ACEP Secretariate	Administrative officer		Physical observation and Utility bills record	Regularly
	Regular work	Traffic and road safety hazard and public safety measures of the building	Traffic and vehicular parking plan will be prepared for operation stage. Necessary fire hydrant and extinguisher will be installed adequately. Emergency evacuation facility has been incorporated in to the design. Provision of health and safety management plan, Implementation of use of personal protective equipment, Provision of potable water and adequate sanitation facilities will be available.	SACEP operational Budget	ACEP Secretariate	Administrative officer		Physical observation and Utility bills record	Regularly

		Unplanned outage	Identification of potential cause; Provision of written management procedures, Regular inspection and maintenance of the backup power supplies and its Automatic Transfer Switch (ATS), Provision of written standard operating procedures (SOPs), Regular training of STP personnel on how to handle unplanned outages and emergencies	SACEP operational Budget	ACEP Secretariate	Administrative officer	Physical observation and emergency preparedness plan of SACEP	Regularly

Note: The Block No. 12,16, 17,18,19,21,23,24,25, 27,29,34,35 mentioned in the attached map have no deeds or valid title documents except ID card issued by the UDA. Regardless of ownership, risk to those structures and occupants is further covered through contractor's insurance and other methods/mitigation measures outlined in this addendum.

ANEXURE I

ASSESSMENT OF POTENTIAL IMPACT ON NEIGHBOR COMMUNITY DUE TO PILING ACTIVITIES AND ADDITIONAL MITIGATION MEASURES TO **ESMP**

Contents

ASSESSMENT OF POTENTIAL IMPACT ON NEIGHBOR COMMUNITY

1.Overview

The construction of the SACEP HQ building is currently underway as part of component 3.1 of the PLEASE project. This effort aims to bolster the regional instructional capacity, enabling member states to transition towards a circular plastic economy.

The land has been obtained from the Sri Lanka Urban Development Authority, located on the 5th lane of D M Colombage Mawatha. It is an almost flat area that was prepared by filling a wetland nearly three decades ago. The preliminary planning work commenced in the year 2020. Following the preliminary design, environmental screening was conducted, and an Environmental and Social Management Plan was prepared accordingly.

Since more details about the detailed design of the building, especially the foundation structure, were not available at the time of preparing the ESMP, it was prepared based on common impacts that can be anticipated in building constructions. Mitigatory measures for all these impacts were well addressed.

However, a soil investigation was conducted in 2022 to determine the type of foundation required for this building. The investigation report indicated the presence of several sedimentary layers, including peat soil, beneath the ground. The bearing capacity of these layers was found to be insufficient to support the proposed building. In light of this, a pile foundation was proposed to construct the building on a sub-surface bearing layer with sufficient capacity to support the superstructure.

The proposed foundation structure will be supported by 25 concrete piles intended to be driven down to the bedrock. These piles are of a relatively medium scale in terms of their proposed diameter and will be constructed in holes excavated by a drilling machine with a diameter of approximately 600 mm.

Generally, piling activities can generate vibrations during excavation due to the frictional force of the cutting head. The magnitude of this impact will depend on factors such as soil type, uniformity, and distribution of the soil layer.

Since there is an interface interaction between the pile and the soil, the vibrations can propagate through the ground, inevitably interacting with structures in the surrounding areas, both above ground and underground.

The vibrations then continue into the structure, where they may disturb occupants and/or potentially cause damage to the structure. The primary factors influencing vibrations resulting from piling activities include the vibrations transferred from the pile to the soil, the geotechnical conditions at the site, and the distance from the source. The extent of vibrations transmitted from the pile to the soil depends on factors such as the type of drilling machine, the cutting head, and the interaction between the pile and the soil.

Based on these factors, an engineering model can be used to forecast the anticipated vibration frequency and particle velocity, allowing for the prediction of the impact at specific points. However, according to the borehole investigation report, it is indicated that this land consists of unevenly distributed loosely packed sedimentary soil layers, including peat and organic soil. Given this soil profile, it is challenging to apply a prediction model that fulfills the criteria of a "perfect" prediction, which would enable the determination of the vibrations that can be expected in particular areas.

The proposed location is in a densely populated urban area where various types of residential buildings are scattered around the construction site. In this context, the piling activity may have an adverse impact on the nearby community in terms of noise and ground vibration.

To address this expected adverse effect, it is essential to gain a proper understanding of the magnitude of the vibration effect and how different types of structures in the area may respond to it

2.Risk assessment and impact management approach

The contractor has conducted a pre-crack survey within an 80-meter radius of the site, and all the buildings located in this zone have already been surveyed. As a result, any cracks or other structural defects in the buildings have been recorded, and the contractor has contractually agreed to restore any expansion or damages that may occur during the pile drilling activities.

However, considering the risk to the lives of the residents in the event of an accident due to the impact on the buildings, several precautionary measures should have been taken into consideration. In this context, the risk level of every settlement located within 80 meters must be initially determined, and damage mitigation measures should be adopted based on that risk classification.

Since a perfect vibration impact prediction model cannot be applied, the risk assessment will be conducted in a two-step approach, and mitigation measures will be tailored accordingly.

I. **Level I:** Risk Classification based on the relative location and structural stability of the building
II. **Level II:** Risk Classification following the first test drilling based on actual impact level is monitored.

2.1 Risk Assessment- Level I

Risk assessment is primarily based on the structural stability of the buildings and their proximity to the proposed construction site. This assessment was carried out by the PIU with the support of the UNOPS engineering team, with a specific focus on identifying the risk level of each household to create a risk map.

According to the assessment, several buildings/part of buildings with poor structural stability that are located near the proposed construction site were found to be at risk of hazardous impacts to occupants. Other buildings may experience moderate effects, such as wall cracking or the widening of existing cracks, if significant levels of vibration and peak particle velocity (PPV) are recorded.

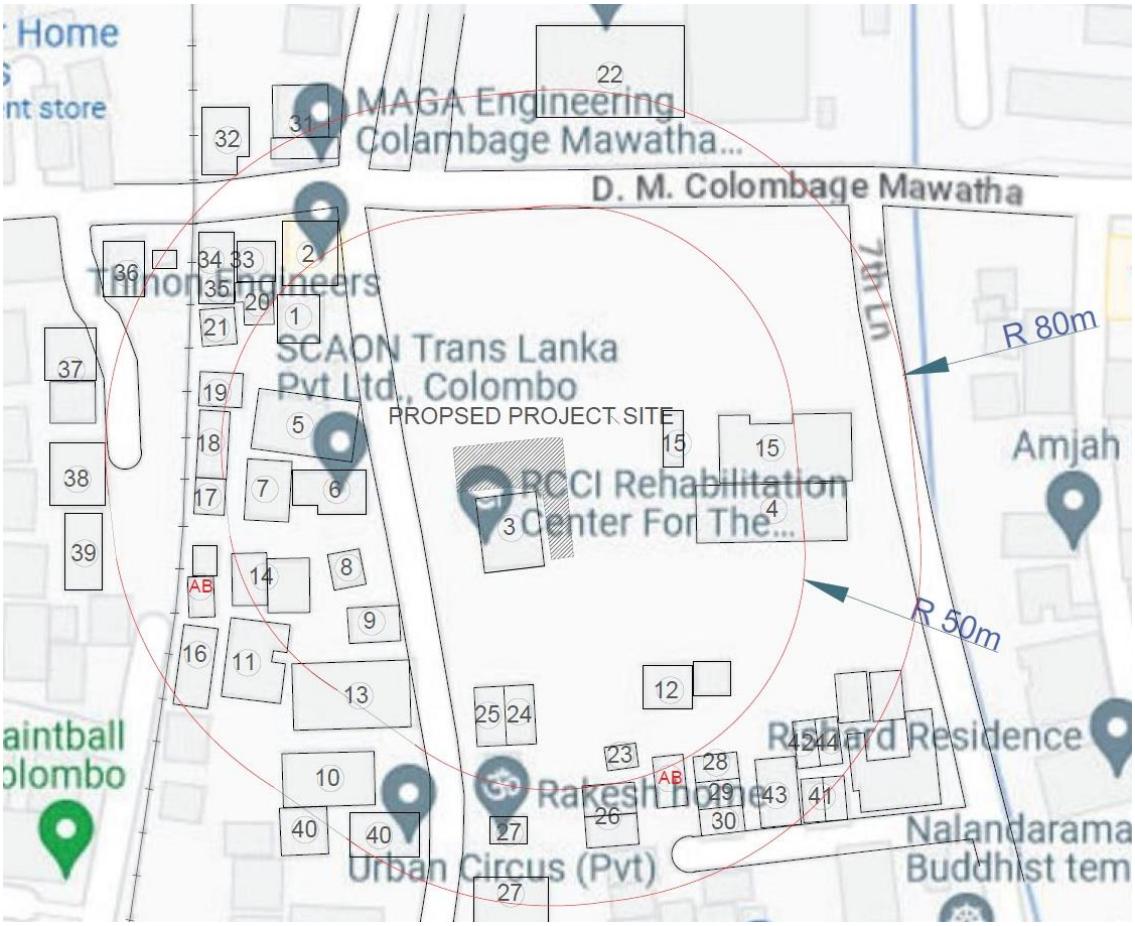
Considering this risk, it was decided to categorize all settlements located in close proximity (within an 80-meter radius) into different risk levels and conduct test pile drilling with a cautious and precautionary approach based on this initial risk classification.

Once the test drilling is completed, this risk classification will need to be verified using actual monitoring data observed during the first test drilling. The test pile drilling will be carried out under close monitoring of all vulnerable settlements, and close communication will be maintained with the community and the construction team to prevent any potential impacts.

2.2 The basis of 1st level risk categorization,

Risk level	Category	General criteria used
High Risk	Physical damage can be expected, which may pose a high safety risk to the occupants	Distance from construction site less than 10 m, therefore the sensitivity for the vibrations shall be higher
Moderate 2	Nuisance vibration may cause formation and enlargement of existing cracks and damage to the building/part of the building	Distance from the construction site is less than 50 m but beyond 10 m, existing building conditions may have shown to be weak with cracks and unstable structures/part of structures, foundation are loose shallow foundations
Moderate 1	Nuisance vibration may cause formation of cracks and partial damage to the building/part of the building	Distance from construction site from 10 m up to 80 m, buildings with RCC framework or masonry structures with brick or block walls, with acceptable structural stability. May also moderate cracks appeared which are not posing significant threats to structural stability
Low Risk	Low probability to make impact but found within 80 m radius	Single or multistory buildings with reinforced concrete or steel framed structures, or buildings which are observed as structurally stable with no or lesser number of minor cracks

3. Location Map



The Map indicating settlements located within the 50 m boundary and 80 m Boundary of the site

4. Summary of the risk Assessment

Block No.	Distance from Site (m)	Existing Condition of the Building	Magnitude of the expected damage
1	36	Single storied, RCC Frame & Block wall Structure, Old Building with a few cracks. Closer to the railway track located within 15 m distance from the railway line.	Moderate 1
2	42	Three Storied, RCC Frame & Block wall Structure, approximately 20 years old structure. Closer to the railway track, located within 20 m distance from the railway line.Very few cracks were found internally and externally.	Moderate 1
3	3	Three Storied fairly new, RCC Frame & Block wall Structure Building, cracks appeared from exterior and	High Risk

		interior. Number of cracks is high. The crack opening sizes vary from 0.1 mm to 0.8 mm. reinforced concrete structure.	
4	26	Two storied, RCC Framed & Block wall structure, relatively high number of minor cracks appeared at the interior.The crack opening sizes vary from 0.1 mm to 0.7 mm. Structural stability is relatively acceptable.	Moderate 1
5	22	Single Storied, RCC framed & block wall structure building, lesser amount of cracks appeared externally. Closer to the railway track located within 20 m distance.Structurally stable.	Moderate 1
6	19	Single storied Steel Building, only the boundary wall is constructed as a block wall. Stability of the structure is high	Low Risk
7	35	Single storied RCC frame & block wall structure. The building plastering was not done in many of the inside and outside walls. The building is still under construction. No significant cracks were recorded. Partially built staircase was found inside the house which needs to be provided a temporary supporting mechanism during the piling to avoid its failure due to possible vibration during piling.	Moderate 2
8	25	Single Storied, block wall structure, with cracks and the condition of the external annexed kitchen/ storage area of the building seems structurally weak. The foundation of the external kitchen is a loose shallow foundation.	Moderate 2
9	27	Single storied RCC frame and block wall structure, with few cracks varying from 0.1 mm to 1.0 mm in width.	Moderate 1
10	56	Newly constructed Three Storied RCC Frame & block wall Structure. A few cracks appeared externally which are not so significant.	Low Risk
11	46	Two storied RCC frame and block wall structure. Cracks appeared internally and externally. Closer to the railway track and located within 15 m distance from the railway track.	Moderate 1
12	28	Two small, block wall structures with a simple RCC structure. Cracks found with average openings. One larger crack around 4 mm in width in one wall close to the external door.	Moderate 1
13			

14	35	Single storied Block wall old building with larger cracks opened from internally and externally. Located closer to the railway track within 15 m distance. The externally annexed kitchen/ storage area seems weak with large opening cracks and may need temporary supports during the piling work to avoid further damage.	Moderate 2
15			
16	60	Single storied, RCC frame and block wall old building with smaller cracks opened from internally and externally. Located closer to the railway track within 10 m distance.	Moderate 1
17	49	Single storied, block wall old building with average cracks opened from internally and externally. Located closer to the railway track within 10 m distance.	Moderate 1
18	49	Single storied, block wall old building with smaller cracks opened from internally and externally. Located closer to the railway track within 10 m distance.	Low Risk
19	46	Single storied, block wall old building with moderate cracks opened from internally and externally. Located closer to the railway track within 10 m distance.	Moderate 1
20	47	A Single storied, block wall old building with few cracks appeared from internally and externally. Located closer to the railway track within 10 m distance.	Low Risk
21	52	Single storied, block wall old building with few cracks opened from internally and externally. Located closer to the railway track within 10 m distance.	Low Risk
22	69	Single storied, RCC frame and block wall old building with a few cracks opened from internally and externally.	Low Risk
23	42	Single storied, block wall old building with only few cracks opened from internally and externally. External walls are not plastered. Shallow foundations with weak bearing capacity.	Moderate 2
24	27	Single storied, block wall old building with average cracks opened from internally. External walls are not plastered. Shallow foundations with weak bearing capacity.	Moderate 2
25	29	Single storied, block wall old building with average cracks opened from internally and externally. External	Moderate 2

		walls are not plastered. Shallow foundations with weak bearing capacity.	
26	49	Single storied, block wall old building with average cracks opened from internally and externally.	Moderate 1
27	55	Single storied, block wall old building with moderate number of cracks opened from internally and externally. External walls are not plastered.	Moderate 1
28	50	Two storied, RCC Frame, block wall, old building with average cracks opened from internally and externally.	Moderate 1
29	55	Three storied, RCC Frame, block wall old building with a few cracks opened from internally and externally.	Low Risk
30	60	Three storied fairly new, RCC Frame, block wall building with a few cracks opened from internally and externally.	Low Risk
31	67	Two storied, RCC Frame, block wall, old building with smaller cracks opened from internally and externally.Located closer to the railway track within 20 m distance.	Low Risk
32	80	Two storied, RCC Frame, block wall, old building with smaller cracks opened from internally and externally. Located closer to the railway track within 10 m distance.	Low Risk
33	52	Single storied, block wall old building with moderate cracks opened from internally and externally. Located within 15 m distance from the railway	Moderate 1
34	61	Single storied, block wall old building with few smaller cracks opened from internally and externally.Located closer to the railway track within 10 m distance	Low Risk
35	57	Two storied old RCC frame and block wall structure. Relatively smaller cracks appeared internally and externally. Closer to the railway track and located within 10 m distance from it	Low Risk
36	79	Single storied old RCC frame and block wall structure. Several cracks appeared internally and externally. Closer to the railway track and located within 10 m distance from it	Low Risk
37	84	Single storied old RCC frame and block wall structure. Several cracks appeared internally and externally. Located beyond the railway track	Low Risk

38	80	Single storied, RCC frame work, block wall building with smaller cracks opened from internally and externally.	Low Risk
39	82	Single storied, RCC frame work, block wall building with smaller cracks opened from internally and externally.	Low Risk
40	62	Two storied, RCC Frame, block wall, relatively old building with large number of smaller cracks (non-structural cracks) opened from internally and externally.	Low Risk
41	72	Three storied, RCC Frame, block wall old building with average cracks opened from internally and externally.	Low Risk
42	60	Two storied, RCC Frame, block wall building with average cracks opened from internally and externally.	Low Risk
43	59	Two storied, RCC Frame, block wall, old building with several minor cracks opened from internally and externally.	Low Risk
44	65	Two storied, RCC Frame, block wall, fairly new building with large number of minor cracks opened from internally and externally. Cracks are not structural cracks and not critical.	Low Risk

Abbreviations

RCC- Reinforced Cement Concrete

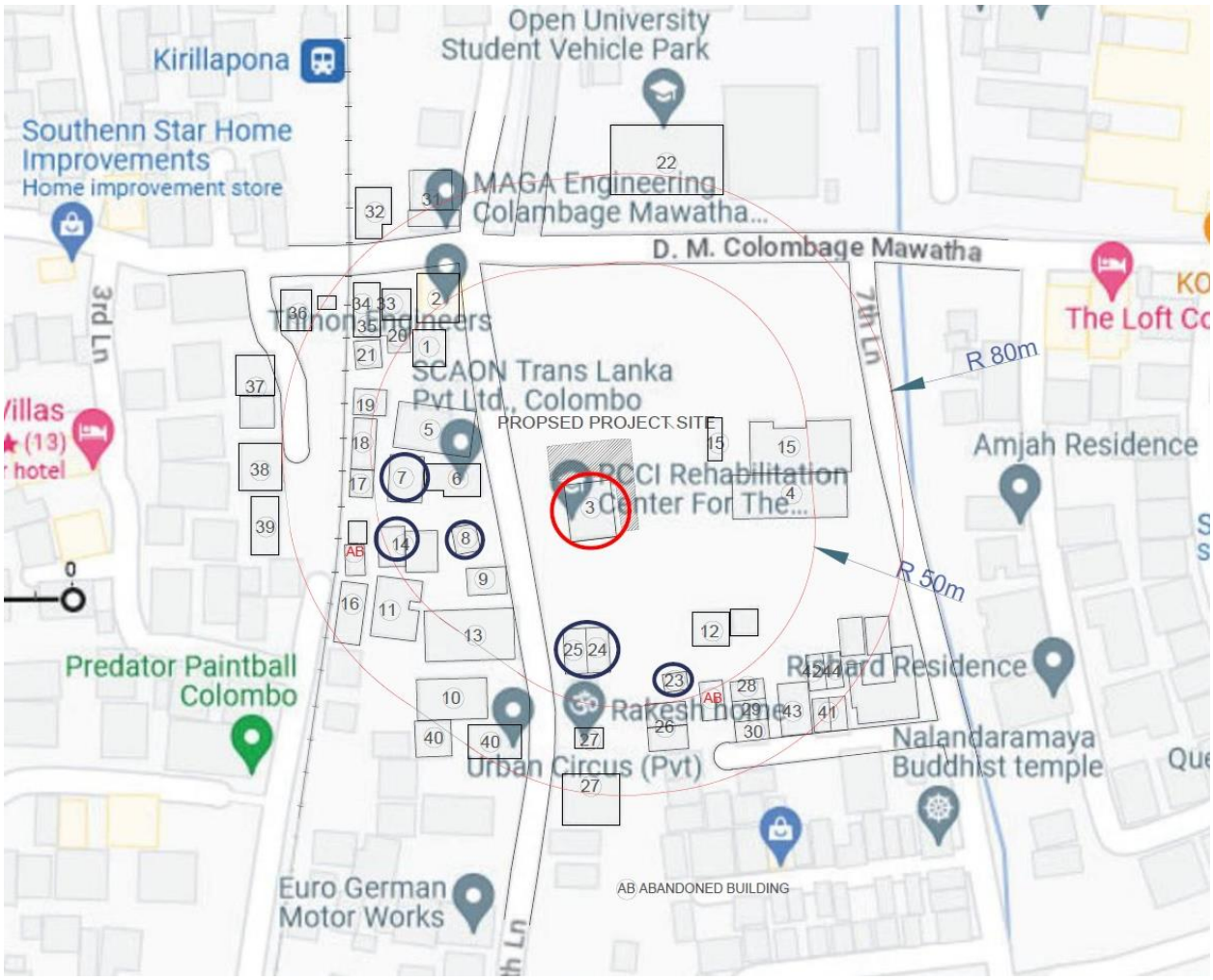
5. Households and institutions which are fallen into the High-Risk Category

High Risk Buildings/ Household	Block Number	Number of Occupants	Mitigation Measures during Piling Work
The Rehabilitation Centre for the Communication Impaired (RCCI) No-25/7, 5th Ln, D M Colombage Mawatha, Colombo-05	03	25	Teaching activities are conducted only during morning hours on weekdays. In the discussion with the management of this school, they were unwilling to move to another location temporarily during the test pile period. Considering the safety and security of affected people, test pile drilling activity will be scheduled out of the school time to avoid possible safety risk to the occupants. If the test pile activities observe that damage occurred to the building and the follow-up piling activities have the potential of bringing greater safety risks to the occupants, temporary relocation needs to be arranged until the end of the piling and rectification activities are completed. The project will provide an alternative location for the school until the rectifications are completed. In such a scenario, communications will be conducted with the Centre as well as relevant national authorities.

6. Households and institutions which are fallen into the Moderate 02 Risk Category

Moderate 2 Risk Building/ Household Block Number	Number of Occupants	Mitigation Measures during Piling Work
07	04	Partially constructed house is at risk due to a half constructed RCC staircase. House owner agreed to stay away from the house during the test pile drilling. The Project Engineering team suggested providing a temporary supporting arrangement to the half-constructed staircase to avoid possible accidental risks due to the ground vibration during pile drilling.
08	01	Since the structural stability of the extended storage room is low, the house owner was informed to stay away from the weakened area of the extended storage area during the test pile drilling and the house owner has agreed. (this is not a frequently used house and only one person staying only at night. However, he does not agree to stay away from the house for a long time).
14	02	Over 70-year-old building has an annexed kitchen/ storage area at the rear end of the house which has shown larger cracks which posed threats to its stability. A temporary supporting arrangement is proposed to the unstable walls to avoid further damages/ falling down during the piling work. (The rest of the house has also shown cracks inside and out.)
23	04	Since the structure is closer to the piling site and the ground condition around the structure is weak, closure supervision for possible damages through deploying Health & Safety officers during the test piling is proposed. Provision of Temporary accommodation is proposed until the piling is completed, based on the Level 2 risk assessment, after the test piling.
24	02	Since the structure is closer to the piling site and the ground condition around the structure is weak, closure supervision for possible damages through deploying Health & Safety officers during the test piling is proposed. Provision of Temporary accommodation is proposed until the piling is completed, based on the Level 2 risk assessment, after the test piling.
25	04	Since the structure is closer to the piling site and the ground condition around the structure is weak, closure supervision for possible damages through deploying Health & Safety officers during the test piling is proposed. Provision of Temporary accommodation is proposed until the piling is completed, based on the Level 2 risk assessment, after the test piling.

7. Location map of the Households and institutions which are fallen into the High and Moderate 2-Risk Categories



Legend:

High Risk Building/ Household Household

Moderate 2 Risk Building/

8.Temporary accommodation arrangement

<u>High Risk - for block number 03</u>

Twenty-five occupants, comprising both staff and students in the building, were identified as potentially vulnerable to the effects of any damage that might occur during the piling process.

The test pile construction shall be carried out during the non-working hours of the school where no occupants in the building and continuous monitoring shall be carried out throughout the test piling to ensure whether there are damages which shall appear in the building. If such significant damages were

observed during the test piling, an alternative plan to relocate the occupants to a suitable location shall be available. The rest of the piling shall be carried out only after the relocation has taken place.

In the event where the level 2 risk assessment recommends a temporary relocation until the repairs are completed, provisions shall be made in the project to accommodate the relocation cost and the estimation for relocation is shown under section 10 in this report. It is estimated that the rectification work may span up to two months from the completion of piling work resulting in overall allocation of relocating cost for 4 months.

Moderate 2- for block numbers 23, 24 and 25

10 people identified as a moderate 02 community should be housed in a safe place during the period of piling (for an approximate period of 2 months during piling and 2 months during rectification period if applicable) if the level 2 risk assessment recommends temporary relocation based on the test piling observations.

A Health, Safety, Social and Environment (HSSE) Specialist will be deployed to the site to monitor the whereabouts of the above-mentioned personnel and communicate on an ongoing basis. An accommodation budget will also be reserved under the project in case these personnel are in need of temporary relocation arrangement.

9. Level II risk assessment

Level II risk assessment will be carried out after the test pile drilling is completed up to the desired depth. During this drilling, actual impact level will be closely assessed by physical observation and instrumental monitoring.

According to the design specifications, this test pile drilling activity will take a minimum of two days to reach the expected depth safely.

To ensure safety during this process, it is recommended to deploy qualified safety officers with construction-related health and safety experience to observe the impact on identified high and moderate 2 buildings located within an 80-meter radius. The safety officers will be provided with an impact monitoring checklist, and they will regularly fill it out based on their physical observations. Additionally, immediately after the first test drilling, the contractor should revisit the crack records that were observed during the pre-crack survey for high, medarate 2 and moderate 1.

9.1 Ground Vibration Level Monitoring,

It is advisable to engage a qualified vibration impact monitoring firm to oversee and record the vibration and noise levels during the excavation of the test piles. This firm should then provide reports on the behavior of the relevant parameters to accurately assess the actual impact.

Ground vibration monitoring will focus to ensure that the vibration triggers are respected for the buildings and structures which are located in the 80 m radius from the SACEP HQ site. Noise and vibration monitoring will be managed to assess potential community impacts and to establish implementing mitigation measures and perfectly rezoning the impact area.

These vibration and noise monitoring equipment like Geo phones and other Sensors has to be installed in at least in 6 locations covering all susceptible buildings which are located in 80 m radius and following parameters will be monitored during the first test pile drilling activity.

01) frequency of a transverse wave
02) V- Vertical in Frequency (Hz) Peak in mm/s
03) Longitudinal in Frequency (Hz) Peak in mm/s
01) Means **Peak** Particle Velocity (PPV-Peak Vector Some in mm/s)

If a high-frequency level or a high particle velocity level is observed at the boundary of the 80-meter radius, further consideration will be given to extending the monitoring zone beyond this radius.

The assessment of vibration levels generated during piling aims to ensure compliance with ISO standards and Sri Lankan standards set forth by the Central Environment Authority for all types of construction work.

A Level II risk map will be created to redefine the boundaries between moderate-risk and low-risk zones, taking into account both physical observations and instrumental monitoring results. Based on this risk zoning, temporary relocation and other mitigation measures for the entire piling period will be determined.

10. Impact prevention and Mitigation cost.

- As per the contract agreement of Contractor who undertakes the piling works, the anticipated damage on buildings and any kind of structures which are found in 80 m radius from construction site shall be rectified by the contractor with his own expenses.
- Ground vibration and noise level monitoring cost is estimated around **LKR 500,000**
- In case of identified damages occurring to the RCCI building, the occupants need to be temporarily relocated to a suitable location until the rectification works are completed. The additional cost is estimated around **LKR 3,000,000**.
- In case of identified risk, the community needs to be accommodated for the entire drilling period and the rectification period, additional cost is estimated around **LKR 3,000,000**.

11. Additional Mitigatory measures incorporated in to the ESMP

Anticipated impact	Preventive measures/Mitigations	Monitoring method	Responsibility	Cost (LKR)
Light to medium damage to identified constructions, such as the formation of cracks in walls/boundary wall	Pre-crack survey was conducted for the 80 m periphery from the construction site. All susceptible buildings shall be inspected after the first test drilling. All buildings located in an 80 m radius should be re-inspected at the end of piling activities and damage caused by the piling activities should be rectified. The pre and post crack survey and rectification are included in the piling constructor's obligation. The estimated maximum damage is at the rectification value of 83,668 USD (Annex I), and the contractor's all risk insurance (CAR) has a maximum coverage of LKR 30,000,000 (Annex II), the equivalent of USD 93,396 per UN exchange rate on 15 September 2023.	Physical observation and measuring the expansion of existing cracks	Contractor	Identified cost will be covered by the contractor and its CAR.
Physical hazards due to possible damage/partial damage to a building	The test piling is scheduled after school hours and during weekends. Possible damages to the building to be rectified by the contractor, immediately.	Physical Observation/ Vibration impact monitoring	Contractor/ UNOPS	The cost will be covered by the contractor and its CAR.
	2nd level risk assessment shall be conducted after drilling the test pile under close monitoring of the impact level at nearby settlement.	Physical Observation Vibration impact monitoring	Contractor/ UNOPS	Incorporated in to the piling contract

	Qualified Safety officers should be deployed in an impact zone covering 80 m radius to regularly monitor the impact and response of structures under the ground vibration.			
	Qualified technical firm shall be deployed in site to monitor the Vibration level with respect following parameters frequency of a transverse wave Vertical in Frequency (Hz) Peak in mm/s Longitudinal in Frequency (Hz) Peak in mm/s Means Peak Particle Velocity (PPV-Peak Vector Some in mm/s) and the result should be evaluated vs the ISO and SL standards during the test pilling	Instrumental monitoring	UNOPS	300,000, already included in the UNOPS Health and Safety considerations
	High risk settlement shall be re-assessed based on the vibration level observed at building during the test drilling period.	Physical Observation/ Vibration impact monitoring with respect to the Frequency and particle velocity. Vibration frequency and particle velocity shall be checked with respect to the ISO and CEA-Sri Lanka standards	UNOPS/ SACEP	N/A
	If the 2nd level risk assessment confirms the high-risk level (includes moderate 2) on particular buildings, Temporary accommodation facilities shall be provided to the necessary PAPs until the end of the piling activity, estimated to be two months.	Physical observation and Community consultation	UNOPS/ SACEP	LKR 6,000,000, to be reserved under the project

Nuisances' vibration and Noise due to the drilling activity	Piling activities shall be scheduled taken into account the minimum disturbance can happened for the nearby people (special reference on The Rehabilitation Centre) For the Communication Impaired) Vibration and noise level shall be minimized by using most appropriate cutting head for the boring machine If the nuisance or harmful vibration level /resonance is continuously observed, the contractor should comply with the engineer's instruction to change the necessary equipment or part of the machinery.	Physical observation/Community consultation Mechanical	Contractor/ UNOPS	N/A

Annex I Damage Estimation

The damage estimation is calculated against 1) magnitude of the expected damage; 2) existing condition of the infrastructure; and 3) distance from the piling site.

Block No.	The magnitude of the expected damage	Existing condition of the infrastructure	Distance from the piling site	Special Considerations	Estimation (LKR Millions)
1	Moderate 1	Old	10 - 50 m		0.375
2	Moderate 1	Moderate	10 - 50 m		0.375
3	High Risk	Fairly New	0 - 10 m	High Risk Location (3 m away from piling)	12.75
4	Moderate 1	Moderate	10 - 50 m		0.375
5	Moderate 1	Old	10 - 50 m		0.375
6	Low	Good	10 - 50 m		0.275
7	Moderate 2	Old	10 - 50 m		0.75
8	Moderate 2	Old	10 - 50 m		0.75
9	Moderate 1	Old	10 - 50 m		0.375
10	Low	Good	50 - 80 m		0.175
11	Moderate 1	Old	10 - 50 m		0.375
12	Moderate 1	Old	10 - 50 m		0.375
13	This is bare land with a demolished building. Therefore, a crack survey is not applicable				
14	Moderate 2	Old	10 - 50 m		0.75
15	Saddhathissa Buddhist Centre. Unable to do the survey. Letters were sent in the Registered Post (RCC framed structure, almost of the same structural status as block no: 04, as appear externally)				
16	Moderate 1	Old	10 - 50 m		0.375
17	Moderate 1	Old	10 - 50 m		0.375
18	Low	Old	10 - 50 m		0.275
19	Moderate 1	Old	10 - 50 m		0.375
20	Low	Old	10 - 50 m		0.275
21	Low	Old	50 - 80 m		0.175

22	Low	Moderate	50 - 80 m		0.175
23	Moderate 2	Old	10 - 50 m		0.75
24	Moderate 2	Old	10 - 50 m		0.75
25	Moderate 2	Old	10 - 50 m		0.75
26	Moderate 1	Old	10 - 50 m		0.375
27	Moderate 1	Old	50 - 80 m		0.275
28	Moderate 1	Moderate	10 - 50 m		0.375
29	Low	Moderate	50 - 80 m		0.175
30	Low	Moderate	50 - 80 m		0.175
31	Low	Old	50 - 80 m		0.175
32	Low	Old	50 - 80 m		0.175
33	Moderate 1	Old	50 - 80 m		0.275
34	Low	Old	50 - 80 m		0.175
35	Low	Old	50 - 80 m		0.175
36	Low	Old	50 - 80 m		0.175
37	Low	Moderate	50 - 80 m		0.175
38	Low	Moderate	50 - 80 m		0.175
39	Low	Old	50 - 80 m		0.175
40	Low	Old	50 - 80 m		0.275
41	Low	Old	50 - 80 m		0.175
42	Low	Old	50 - 80 m		0.175
43	Low	Old	50 - 80 m		0.175
44	Low	Moderate	50 - 80 m		0.175
	Reservation amount for the property which are not added in the above calculations				0.5
			LKR (Mn)		26.875
			USD		**83,668**