REDUCTION OF LANDSLIDE VULNERABILITY BY MITIGATION MEASURES PROJECT

Site Specific Environmental and Social Management Plan

Site No. 156
Rockfall site at Ella Wellawaya Road (A023) at 14th mile post near culvert No.25/1

Badulla District

December 2024

Prepared for:

ASIAN INFRASTRUCTURE INVESTMENT BANK

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Abbreviations

AIIB	Asian Infrastructure Investment Bank
CEA	Central Environmental Authority
DFC	Department of Forest Conservation
DS	Divisional Secretary
DWLC	Department of Wild Life Conservation
EH & S	Environmental Health & Social
E&SU of PMU	Environmental & Social Unit of Project Management Unit
ESMF	Environmental and Social Management Framework
SSE&SMP	Site Specific Environmental and Social Management Plan
ESMP	Environmental and Social Management Plan
GN	Grama Niladhari
GOSL	Government of Sri Lanka
GSMB	Geological Surveys & Mines Bureau
NBRO	National Building Research Organisation
PRDA	Provincial Road Development Authority
RHS	Right Hand Side
LHS	Left Hand Side

1. Introduction

1.1 Project overview

The Government of Sri Lanka has received a loan from the Asian Infrastructure Investment Bank (AIIB) for mitigating/rectifying unstable slopes in high-risk areas especially in 13 districts of 06 provinces of the country under the Reduction of Landslide Vulnerability by Mitigation Measures Project (RLVMMP). The project requires to be implemented in accordance with environmental and social safeguards and mandates of the AIIB and that of Sri Lanka. Considering the nature of project actions and its implementation, an Environmental and Social Management Framework (ESMF) has been prepared as required by the AIIB environmental and social safeguard policy.

The purpose of the Environmental and Social Management Framework (ESMF) is to provide a guide for the application of AIIB safeguards and national environmental and social mandates during the implementation of project actions. The project implementing agency (NBRO) is expected to ensure implementation of environmental and social management plans prepared under the ESMF during all phases of project implementation so that the impacts on the environment and community are minimal.

During the scoping exercise, it was revealed that the environmental & social setting and health & safety conditions are more site specific, and require to be addressed specific to site conditions. Therefore, the ESMF has recommended site specific environmental and social assessments followed by Site Specific Environmental and Social Management Plans (SSE&SMP) for each site. The SSE&SMP gives planning, design, construction and operation phase environmental, social, and health & safety management measures to be considered in the project Implementation.

This is the site-specific environmental and social management plan for **Rock fall at Ella Wellawaya Road (A23) at 14th mile post (culvert no 25/1)** selected for rock fall mitigation site under RLVMMP. This plan has been prepared by an in-depth environmental and social assessment to:

i. Identify sensitive environmental and social elements in the project influence area
ii. Identify significant environmental and social impacts due to project actions
iii. Propose mitigation measures
iv. Decide appropriate environmental and social monitoring requirements specific to this project
v. Study relevant environmental regulations and procedures to be followed during project implementation specific to the site

1.2 Intended users

The document provides an in-depth insight into site-specific environmental and social issues associated with the proposed project and the mitigation measures and intends to be used by the landslide mitigation design team, the PMU, and the contractor in the implementation of the Environmental and Social Management component of the project. The SSE&SMP is published on the project website (https://rlvmmp.lk/) and can be viewed by a wide range of interested parties (public, stakeholder organizations) can be utilized by the contractors for the project and will form the basis of site-specific management plans that will be prepared by the contractors as part of their Site Specific Environmental and Social Management Action Plans (SSE-SMAP) prior to commencing works.

2. Description of the project

2.1 Name of the project

Rectification of Site No.156, Badulla District, for **Rockfall at Ella -Wellawaya Road (A23) at 14th mile post (culvert No. 25/1)**

2.2 Location details

The proposed mitigation site falls under Ella GN division of Ella DS division, Badulla District, Uva Province.

GPS references of the site– 6.861542°N and 81.054488°E

Nearest town and accessibility to the site – Ella

Ella town is about 1.1km from the site. The site can be accessed via Ella Wellawaya (A23). (*Ref. fig. 1*)

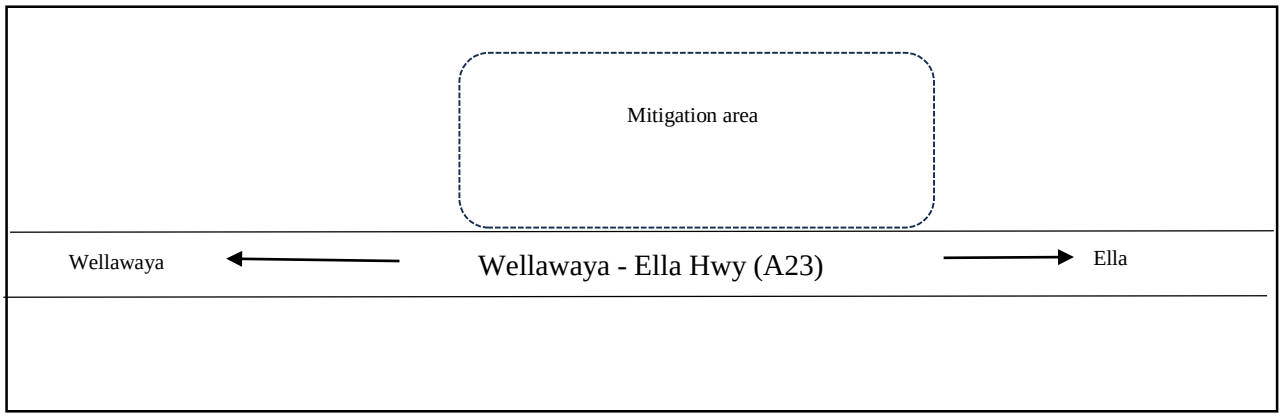

Figure 1:Road map showing the accessibility to the site

2.3 Topography and land ownership

The proposed mitigation site is located within a steep sloppy land and road reservation area at the Ella Wellawaya road. The elevation of the area is about 1041 m. the extent of site proposed to be mitigated is about 600 m^2 and affected area is about 2000 m^2. The rock falling risk area is located in a steep sloppy terrain where the natural slope has been cut for the road construction. The land ownership of the upslope area is private ownerships and the road reservation is owned by Road Development Authority
Refer figure 2; Google images of the proposed rock fall mitigation site, the surrounding environmental features and service infrastructure.

Figure 2: Google image of the proposed rock fall mitigation site, the surrounding environmental features and service infrastructure

2.4 Meteorology of the area (Ella)

Annual average rainfall – 1652 mm
Annual average temperature – 21.2 ºC
(Source: https://en.climate-dara.org)

3. Rock fall hazard incident details

3.1 Account of incident

According to the residents and government officers of the area, occasional rock falls have been reported on this road, during periods of high rainfall. A massive active rock fall was recorded on 27th October 2019 at the above location. The rocks and the soil mass fall incident happened on the left-hand side (LHS) of the A023 road to Wellawaya. The entire road has been blocked and closed for 15 days. During the incident, the fallen rock boulders obstructed the traffic fleet, tourism, and business activities of the area. (*Refer to Fig 3: cross sections, land use of the location).*

3.2 Effects and consequences of rock fall

No accidents or causalities were recorded due to the rock fall incidents. Cracks on the road and road subsidence were observed as the physical damages to the road.

3.3 Description of any remedial measures already undertaken to reduce the potential risk

According to the request made by the District Secretary - Badulla, a preliminary field study was conducted by the Scientists of the National Building Research Organisation of Badulla Office on 30th October 2019 with the RDA officers. Accordingly, considering the risk situation and the emergency at the place, a metal fence was established on both sides of the road to prevent rocks from falling as a temporary remedial measure. The site investigation report has recommended long-term and short-term rectification measures for the site to maintain slope stability and design to prevent rock falling.

3.4 Evacuations

There are no risk houses to be evacuated.

3.5 Resettlement (progress)

There are no risk houses to be resettled
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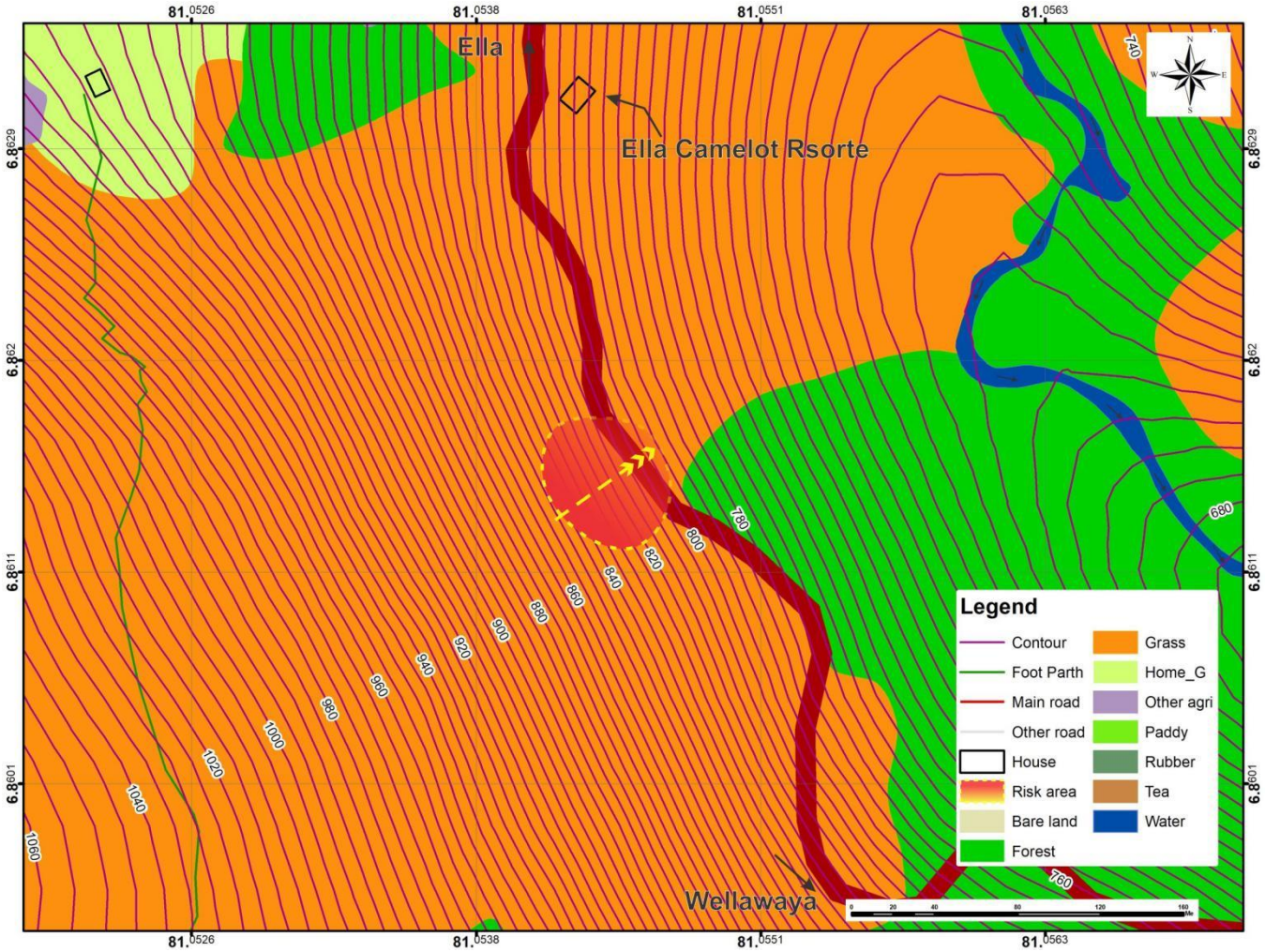

Figure 3: land use and risk elements of the location

4. Description of the area of the rock fall and areas adjacent to the rock fall and current level of risk

4.1 Area of the rock fall

The Ella-Wellawaya Road was constructed nearly in the 1950s and its initial part mostly runs along a talus slope with steep rock escarpment. According to the geological and morphological settings of the area, rock falls and debris flows are common in this part of the road at any time. According to the field examination, the geologists made the following observations.

At this location, the Ella-Wellawaya Road crosses the steep slope gradient (60°-70°) between the Ella rock and Kirindi Oya. The upper slope consists of an escarp (Reverse Dip) slope with migmatized gneissic bedrock exposures. Slope failure occurred earlier adjacent to the road, at a spur situated between 2 dry valleys oriented parallel to the dipping direction. A significant amount of unstable debris (rock and soil) is resting at the upper part of the slope consisting of rock blocks of about 0.2m3 to 3m3 . They have been displaced with vertical and lateral displacement of about 1.5m and 1m respectively. According to the visual observations, the unstable debris mass (rock and soil) is about 500m3. Above the displaced mass, there is a certain amount of soil and embedded rock boulders up to the massive rock surface.

The upslope area is dominated by the small tree species and bushes and rock boulders. This area is highly vulnerable for rock falls. Seasonal recharging water seepages can be observed from the upslope area. The affected road; Ella Wellawaya is the only main access road to the Wellawaya area which provides the facilities and services to the people. The downslope area is also a steep slope.

4.2 Areas adjacent to the rock fall

The surrounding upslope area of the unstable rock fall slope section contains mostly grass and small tree species and the area is mountainous with steep slopes. A village with settlements and paddy fields is located in further downslope.

The most famous waterfall called ‘Rawana Fall” is located adjacent to the rock fall site. Ella rock and the natural landscapes are located around the unstable area. Both local and foreign tourists visit these places through this Ella Wellawaya main road. Rawana Falls is one of the most popular destinations that you can see while passing this road. There are also other many tourist attractions around the area where people can use this road to visit these places. Some of these tourist attractions are Adisham Bungalow in Haputale, Liption’s Seat, Ella, Badulla, Dunhinda waterfall, Nuwaraeliya, etc.

4.3 Current level of risk

The unstable rock blocks have collapsed into the road from time to time followed by heavy rainfall and therefore, the road and its users are in definite danger. These rock falls will occur again with the upcoming rains and the road will be blocked. During the rainy season, it poses a high risk to commuters and vehicle transportation on the road, as tourists who visit the Rawana Fall, community in the Wellawaya area. After removing the unstable mass, there is a possibility to be destabilizing the soil slope with embedded rock boulders up to the massive rock, hence, a mitigation procedure with detailed study is required.

If the site is not rectified to prevent future rock falls, it will disturb all functions of vehicle transportation between Ella and Wellawaya. The commuters, pedestrians, tourists, nearby residents, and their livelihood activities would be at risk due to this unstable rock fall slope section. The obstruction of accessibility may pose a significant impact on the tourism sector of the country, lifeline facilities, services, and related economic activities including transactions.

5. Description of the works envisaged under the project

Based on preliminary investigations, NBRO has carried out detailed investigations and designed suitable rectification measures to minimize the risk posed by this unstable rock fall section to ensure the safety of the commuters, tourists, continued and uninterrupted function of this main road. Further rock falls are possible at this location especially with the heavy rain continued and therefore following recommendations are given to reduce the immediate risk.

- Removal of unstable rock fragments by chemical/ control blasting techniques based on the location specific situation
- If rock blasting is needed in this regard, control blasting techniques with minimum explosives should be implemented by experienced personals or contractor. Otherwise the explosions may create further instabilities in the surrounding area
- Detailed geotechnical investigation should be carried out to design proper mitigation measures like rock fall prevention net, rock fall prevention fence, anchoring or combination of the above measures
- To minimize the potential damage from rock falls along the vertical rock slope it is proposed to install a rope net (rope fixation type rock fall prevention method).
- To minimize the damage from falling detached rock boulders resting on the slope, a pocket type high intensity rock fall protection net should be installed along the edge of the road.
- Detached boulders resting on the slope should be removed using chemical/ control blasting techniques, ensuring that debris removal is conducted safely and without damaging the road section.

6. Brief description on the surrounding environment with special reference to sensitive elements that may be affected by the project actions

The elements and services at risk during the project implementation are;

i. Ella - Wellawaya road in at 14th mile post
ii. Commuters and pedestrians
iii. Local and foreign tourists
iv. Water seepges
v. Current services, economic and tourism activities of the area

(Ref. Fig.4 Sensitive elements that may be affected by the project actions

Figure 4a: Failed soil mass with rock boulders

Figure 4b: Cracked and subsidized section of the road

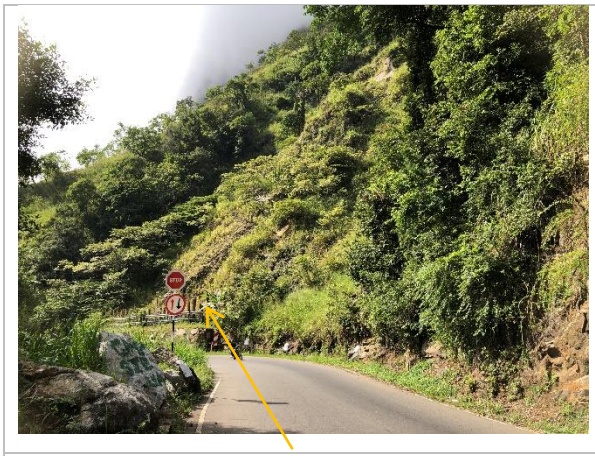

Figure 4c: Mitigation site with sign board

Figure 4d: Rock boulders and soil masses rest at the downslope

Figure 4e: Temporary constructed metal fence and rubble wall

Figure 4f: Ella Wellawaya road at the mitigation site

Figure 4g: Tourists at the Rawana Fall

Figure 4h: Water seepage through the upslope area

Figure 4: Sensitive elements that may be affected by the project actions

7. Identification of social and environmental impacts and risks related to the works

7.1 Positive impacts

- The objective of this project is to ensure that further occurrence of rock fall to be prevented at an acceptable level. The remediation may secure the cost of road rehabilitation from future rock fall in the area. This area is considered by many to be one of the most scenic area in Sri Lanka. This area has population centers such as Ella and many tourist destinations. The

proposed project will significantly enhance safety of the road for commuters, tourists, and pedestrians during rainy season and will allow keeping the road open throughout the year.

- Small scale business activities related tourism in the area will benefit largely from this mitigation.
- Downslope community and settlements will be prevented from rock falls of future slope failures.

7.2 Negative impacts

The mitigation works are generally confined to fallen rock areas. Therefore, negative impacts are much localized and also limited to the construction period.

Table 1: Negative impacts and their level of significance

Impacts during the construction period	Level of Significance
7.2.1 Hydrological and water quality impacts	
7.2.1.1 Impacts of the drainage pattern of the area Disruption to existing surface and sub-surface drainage patterns in the area is envisaged with the project implementation. During the rainy season heavy flow of water is expected to be generated and accumulated between the road and the slope. The water inundation of the existing drainage may be expected. An increase of water through the unstable slope may intensify the risk of rock fall of the unstable section.	**Significant**
7.2.1.2 Water pollution and impacts on surface water quality During the slope excavation, the removal of debris and rocks can generate high sediment-laden runoff there could be a possibility that contaminated runoff may pollute the water. Improper disposal of oils and other harmful substances/contaminants from machinery, leakages from temporary storage tanks, solid waste and wastewater disposal/dumping could occur causing adverse impacts on the quality of the water. However, during the rainy season, the rainwater running through the disturbed slope tends to pick up sediment, oil and other pollutants generated during construction can contaminate the water. As there are seasonal recharging water seepages nearby, the water pollution impact is low significant	**Low Significant**
7.2.1.4 Open defecation and waterborne infections As the site is located close to the road, the possibility of open defecation is low.	**Low Significant**
7.2.1.5 Impacts on the downslope water users The construction activities will be carried out on steep slopes with consisting of unstable rocks. Therefore, the slope will be prone to rock falls during the rock removal phase. This may increase the risk of rock falling into downslope area. As there is no water stream in the downslope area, the rock or sediment loading impact is insignificant.	**Insignificant**
7.2.1.6 Impacts on groundwater table and groundwater quality Addition or mixing of construction materials including cements, grout materials with sub-surface water flows will cause temporary water quality degradation and accumulation of unwanted substances. During the construction period, the hazardous waste from chemical substances, wastewater from the construction activities and discharge of waste matter from onsite septic systems would cause adverse impacts on the groundwater quality as the water of the downstream may use by the residents. Due to the mitigatory activities carried out in the slope area, the ground water quality or water table draw down impacts will not be significant because there is no ground water sources in that area.	**Insignificant**

7.2.1.7 Impacts on water or wetlands Improper disposal of oils and other harmful substances/contaminants from machinery, leakages from temporary storage tanks, solid waste and wastewater disposal/dumping from workers' sites could occur causing adverse impacts on quality of the water. This impact may not significant as there are no water streams nearby.	**Insignificant**
7.2.2 Environmental Impacts	
7.2.2.1 Noise and vibration impacts Noise and vibration are expected from construction equipment. The tourists, vendors, the pedestrians and commuters on roads will also have an effect from noise and vibration. The commuters, tourists on the road will be exposed to high noise during heavy noise generating activities, such as operating loading and unloading of materials, movement of machinery in addition to above mentioned construction works.	**Highly Significant**
7.2.2.2 Air pollution impacts Construction activities that contribute to air pollution include: land clearing, operation of diesel engines, demolition and burning. Operating vehicles at high speed under dry weather conditions can increase such pollution. Improper handling and transferring of materials can also generate dust. Improper storage of materials can potentially generate dust if not properly covered. During construction, it generates high levels of dust typically from concrete, cement, wood, stone, and silica. The road is used heavily for vehicles moving (buses, bicycles, lorries, trucks, tippers, three wheels). The air pollution may have significant impact on the tourists, commuters and pedestrians. The air pollution impacts from the construction are locally significant during dry periods for commuters, nearby residents and tourists. .	**Highly Significant**
7.2.2.3 Solid waste disposal issues Haphazard disposal of solid waste; various types of waste such as litter, food waste, construction waste will be generated and may store or dispose on site. The littering and hap hazard storage and disposal of solid waste in and around the site will create inconveniences to the nearby residents, commuters, pedestrians and tourists. It can block the drainage to make breeding grounds for water borne diseases. Waste can pollute the soil, and leave various environmental impacts if proper disposal mechanism is not in place during the construction period.	**Highly Significant**
7.2.2.4 Explosive hazards and hazardous materials Since the affected area has many rock boulders, explosives may be used if the rock blasting is envisaged. This may pose a risk due to unsafe use. As these operations are to be done on affected slopes the risk of improper use of explosive and accidents from rock fragments are highly significant.	**Highly Significant**
7.2.3 Biological /Ecological Impacts	
7.2.3.1 Effects of Important Wildlife Habitats There are no forested/ wild-life reservation areas within the project influence area with high biodiversity.	**Insignificant**
7.2.3.2 Effects on Fauna & Flora Majority of the trees found in the area are not endemic, threatened and identified in the red list of IUCN.	**Insignificant**
7.2.4 Social and Economic Impacts	
7.2.4.1 Impacts on agriculture within the area to be remedied/ immediately to the site There is no any cultivation immediately adjacent to rock fall slope area. During the construction period, the land use pattern may not be affected.	**Insignificant**

7.2.4.2 Cracks in the road/houses due to vibration and blasting impacts The unstable rock fall land is located adjacent to a road. The road is running through the site. Vibrations can create cracks on the road. The down slope settlements are located within the downslope of the proposed mitigation site. Therefore, vibration and rock blasting impacts on the down slope house are highly significant. During the construction heavy machinery and chemicals for blasting will be used and the vibration can widen the cracks and may create new ones in the downslope houses.	**Highly Significant**
7.2.4.3 Loosing access to land and future development activities The land where the project activities are envisaged belongs to the road reservation of RDA and the mitigation works will be concentrated on upslope of the road. This area is a mainly a sloppy land, there will be no impacts to the land owners with regard to loosing access to the land (during construction) and loss to valuable use of the land. In contrary, remediation works in the upslope will increase the stability of the boundary and protect the land from future rock falls.	**Insignificant**
7.2.4.4 Impacts on livelihood/ business and income activities The tourism activities related to the Rawana Falls and the view of the area immediately adjacent to the unstable rock fall site would be affected during the construction period. Both local and foreign tourists, small business owners, vehicle parking facilities	**Highly Significant**
7.2.4.5 Impacts on service provision (water supply, sewage, electricity) The road, electricity, water supply lines running through the mitigation area will be impacted.	**Significant**
7.2.4.6 Effect due to loss of infrastructure and safety During construction phase the main road from Ella to Wellawaya road will be obstructed by frequently moving machinery, loaders, trucks etc. as the road is very narrow and bending. Therefore, most of the heavy machinery, trucks and loaders can obstruct the pedestrian passage, parking area and cause traffic during the construction period.	**Significant**
7.2.4.7 Work camps and lay-down site requirements The camp site will be selected in the neighbourhood of community. If proper camp management is not in place, it may result several labour issues, social issues with community, conflicts for shared resources with the community, nuisances, and management of waste etc. If temporary camps are built in the close proximity of the site, management of solid waste and sewage will be an issue.	**Significant**
7.2.4.8 Relations between workers and people living in the vicinity of the site and possibility of disputes The construction workers at this site will be from different social backgrounds and from different geographical areas often under poverty. Usually, they are with poor educational and social background. Such communities may have a wide range of social issues to cause dis-stress on the neighbouring community and the workers of the project. Although the workers who would engage in such issues will be rare, even few possibilities cannot be ignored.	**Highly Significant**
7.2.4.9 Workers safety during construction The workers may be exposed to risk from falling. Fatal injuries may occur if the rock falls. The risk of rock fall is aggravated during the rainy season. This risk is highly significant. Risk of hazard from vehicle and construction machinery accidents is highly significant at this site. Contractor may engage under age workers (children) for construction work, which is risky and can results serious accidents and injuries.	**Highly Significant**

7.2.4.10 Safety to the public from construction activities: High risk for commuters/tourists During construction phase the road will be obstructed by the frequently moving machinery, loaders, trucks etc. As most of the mitigation works are to be carried out in limited space on slopes the heavy machinery, the trucks and loaders etc. can obstruct the commuter /downslope residents/tourists and may pose high risk on their life. There is a risk of falling loose rocks on the road during excavations and removal of rocks posing risk on the residents who live in nearby two houses, commuters.	**Highly Significant**
7.2.4.11 Impacts on transport infrastructure (especially temporary loss of road, risks of traffic congestion) The traffic due to full/partial road closure may obstruct the smooth flow of vehicles during the week days, in office hours, school times, on holy days. This will cause nuisance to pedestrians and commuters	**Significant**
7.**2.4.12 Areas used for businesses, agriculture or other immediately adjacent to the site** The impact will not be triggered as there are no businesses, agriculture or other immediately adjacent to the site	**Less Significant**
7.2.4.13 Need for people to enter or cross the site Excavation machinery, loaders, trucks etc. will be used in the area used to access in to the unstable slope area. There is no special need for commuters and neighbouring community to enter the site for other purposes. Construction may use materials such as metal aggregates, steel etc. which can be injurious under improper storage and handling. However, unauthorized entry of ordinary people may occur due to intentional or unintentional purposes and they may be at risk due to operating machinery, vehicles, electricity, and may be blasting materials.	**Highly Significant**

8. Site Specific Risk Analysis

Table 2: Site specific risk analysis

Risk	Affected group	Risk level
1. Facing accidents when working close to the road (as there is a large bend close to the site)	Workers	Very high
2. Transporting materials and machinery	Workers/ tourists	Very high
3. Throw out disposals (litter, bottles, and food) to the construction site from the commuters.	Workers/tourists/ commuters	Very high
4. Facing accidents during constructions at night time	Workers	Very high
5. Accidents from the construction activities and materials placed close to the road	Workers/tourists/ Commuters	Very high
6. Injuries due to rock particles due to explosions/ blasting	Workers/tourists/ /Commuters	Very High
7. Rock fall from the unstable area	Workers/tourists/ Commuters	Very High
8. Work with electrified supply lines	Workers	High
9. Site Working – Working in poor visibility	Workers	High
10. Lone Working	Workers	High
11. Emergency evacuation	Workers	High

12. Extreme weather conditions (wind, rain etc.)	Workers	High

9. Significant Environmental and Social Impacts

Environmental, social impacts or risks that will require special attention on the part of NBRO.

9.1 Priority Health and Safety Issues. Specific H&S concerns that require measures that go beyond the standard contractual requirements for contractors

The health and safety issues pertinent to this site is significant as the workers have to work on an unstable slope with a risk of rock falling. Such common E & HS issues have been discussed in the **ESMF**. Worker safety requirement in the construction site is more detailed under 2003 5: Safety equipment and clothing in the section 2003: Working conditions and community health and safety in the bidding document.

9.2 Child labour & forced labour

Child labor & Forced labor is detailed under 2003.3 under section 2003: Working conditions and community health and safety in the Bidding document.

10. Environmental Social Management Plan (ESMP)

Measures to manage and or mitigate the impacts and risk. Especially the significant impacts and risks identified in sections 7 & 8. This section will include the specific recommendations and requirements of the ESMP for design stage, construction phase and maintenance operation phase.

10.1 Resettlement action plan

There is no project-based resettlement in this site.

10.2Evacuation of people

Project based evacuations are not required for this site.

10.3Procedure for removal of damaged structures, facilities infrastructure (consent from owners to remove the articles)

This risk may not be triggered in this site.

10.4 Requirement for compensation for loss of property /uses due to project actions

This risk may not be triggered in this site.

10.5 Public awareness and education- needed for following areas

i. Programs to inform and educate people in the vicinity and the nearby vendors related tourism about the risks posed by unstable rock land section.
ii. Requirement for special awareness for tourists, commuters and the people passing through the area using the road with potentially high-risk during construction phase and early warning.

10.6 Design based Environmental/ Social Management considerations

The site is located in an aesthetically beautiful, environmentally sensitive natural environment in the rural setup. Hence, following environmentally and socially significant design considerations are recommended.

Table 3: Design stage Environmental & Social considerations

Design feature	Recommended level of consideration for this site
i. Natural resource management and resource optimized designs Project specific designs should be considered to eliminate mass clearing of vegetation and minimum number of removals of grown tree species. Sufficient emphasis should be made to consider conservation of trees if important tree species are found.	Very High
ii. Site Planning During site planning it is necessary to be cautious on possible re-activation of rock falls. Also, the site is located in a very limited space of a slope with a road. The vehicle parking sites, material storage and temporary shelters etc. should not be installed in the danger zones of the rock falls. It is very necessary to keep trained flagman or safety officer during the construction period and proper communication between contractor's workforce and the other responsible officials should be maintained.	Very High
iii. Habitat connectivity and animal trails If large fractions of vegetation are required to be cleared in ecologically fragile habitats as for permanent structures or for access, or if deep drains etc. are to be made the designs should include habitat connectivity features, animal trails and vegetation strips and etc. even if the impacts are localized.	Moderate
iv. Conservation of water resources If involves extraction of water both surface and sub-surface. The water extracted is in relatively good quality. In a well thought design this extracted water can be conveyed in such a manner that the water can be accessed by wild fauna as well as the neighboring communities for bathing and other domestic purposes .	Low
v. Interruption to water supplies If the water in the mitigated slope is used as a source for individual or community water supply, the chance the water source can be affected by the mitigation work is high due to water table draw down.	Low
vi. Aesthetically compatible design considerations The designs in aesthetically sensitive environments should consider structures that blend with natural environment to keep the visual pollution to minimum. Greening could be used in construction activities to develop the area as a tourist attraction. Service of landscape architect may be important for the design of suitable mitigation structures.	Very High for upslope area
vii. Consideration of green environmental features As many of the mitigatory works are carried out in ecologically sensitive habitats, it is recommended to consider green environmental designs as much as possible in the designs e.g.: use of local vegetation species for erosion control, combination of plants to sustain species diversity in the environment, avoiding inclusion of potentially invasive species & etc.	Very high for upslope area
viii. Conservation of environmental, social and cultural features The local cultures and heritages are strengthened by their close connections to the natural environment that sustains them. Any constructions of closing this Rawana Fall is prohibited Therefore, the project actions should be carried out considering local culture and social aspects, providing opportunities to reinforce them during the project actions.	Very high for

ix. Workers/ commuters and community safety Due to the close proximity to the roads people may face accidents specially the workforce during the construction phase. Unauthorized entry and ignorance may cause severe accidents around the site. Activation of slides or ground subsidence may occur during construction phase and may pose threat to workers of RDA, tourists, businessmen, passengers and commuters. Therefore, design-based safety consideration such as beams, safety nets etc. should be considered.	Very high
x. Erosion control structures During rainy season the flow of drainage structures can be significantly high and this may cause stream bed erosion. Hence the design should adequately consider flow speed breakers to reduce erosive flows entering natural streams. This should be an inclusive part of the design if there are streams and culverts in the proximity of the mitigation site.	Low
xi. Low post maintenance and operation designs The mitigation should consider passive techniques such as gravity drains for drainage management. Correct pipe diameters, pore diameters and laying angles should be considered to avoid clogging of drains. Low maintenance structures and designs such as designs to withstand erosive forces, sediment trapping systems etch should be considered if drain water is expected be directed to natural streams. The materials used for structures and should be chosen carefully so as to withstand weather conditions with high durability. Designs should specially consider corrosion prevention techniques if steel structures are used.	Very High

10.7 Mitigation of impacts during the construction phase

10.7.1 Construction contractors' requirement to comply with environmental and social management during the construction phase

Measures to manage and to mitigate the environmental and social impacts are generally common to all landslide mitigation sites. Such impacts are largely attributed to activities in the construction phase. The mitigation of impacts therefore becomes an obligation of construction contractor. NBRO has prepared a comprehensive document on "***contractors' requirement to comply with Environmental and Social Health and Safety (ES & HS) management during the construction phase"*** to be included in construction contractors' bid document. The main sections are summarized below (Table 4) indicating the degree of relevancy for this site. For details ESMP for construction contractors should be referred.

Table 4: Contractor requirement to comply with ES & HS

Reference No. as per construction contractor's obligation to ESMP	Item	Relevant to the project
2002. Environmental and Social Monitoring		
2002.2 1)	Storage on site	Highly Relevant (road reservation)
2002.2 2)	Noise and Vibration	Highly relevant (commuters, tourists)
2002.2 3)	Cracks and damages to the buildings	Relevant
2002.2 4)	Disposal of waste	Relevant (commuters, tourists)
2002.2 5)	Disposal of refuse	Highly relevant (road reservation)
2002.2 6)	Dust control	Highly Relevant (commuters, tourists)
2002.2 7)	Transport of Construction materials and waste	Relevant
2002.2 8)	Water	Relevant
2002.2 9)	Flora and Fauna	Relevant
2002.2 10)	Physical and cultural resources	Relevant
2002.2 11)	Soil Erosion	Relevant
2002.2 12)	Soil Contamination	Relevant
2002.2 13)	Borrowing Earth	Relevant
2002.2 14)	Quarry Operations	Relevant
2002.2 15)	Maintenance vehicles and Machinery	Relevant

2002.2 16)	Disruption to public	Highly relevant (community, tourists nearby)
2002.2 17)	Utilities and roadside amenities	Highly relevant (road)
2002.2 18)	Visual environment enhancement	Highly relevant
2002-5. Environmental Monitoring	Baseline surveys (air, water, noise, vibration, crack surveys)	Refer site specific monitoring plan
	Surveys during construction (air, water, noise, vibration, crack surveys)	Refer site specific monitoring plan
	Surveys during operation phase	Refer site specific monitoring plan
	Reporting and maintenance of records	Relevant
2003. Working Conditions and Community Health and Safety		
2003.2	Safety organization and communication	Highly relevant (unsafe slope, commuters, tourists, pedestrians, heavy machinery)
2003.3	Child Labor and Forced Labor	Relevant
2003.4	Safety reports and notification of accidents	Highly relevant
2003.5	Safety Equipment and Clothing	Highly relevant
2003.6	Safety inspections	Highly relevant
2003.7	First Aid Facilities	Highly relevant
2003.8	Health and safety information and training	Highly relevant
2003.9	Plant equipment and qualified personnel	Relevant

Relevant: *The section is relevant to the site as a common ESMP applicable to any site*
Highly relevant: *The contractor should pay special emphasis in the preparation of environmental method statements to ensure that the relevant ESMP is implemented specific to the site*
Possibly relevant: *This ESMP will be triggered if the site come across with relevant aspect during project implementation*
Not relevant: *The section may not be relevant to this site under disclosed conditions*
Optional: *require to be implement if needed only*
Refer site specific monitoring plan*: Contractor is obliged to carry out monitoring as specified in the site-specific monitoring plan*
Reference: Contractors Obligation for implementation of ESMP

10.7.2 Site Specific mitigation

Given below are the site-specific mitigation measures that the project is expected to implement during the construction period.

Table 5: Site specific ES & HS mitigation measures

Mitigation item	Project implementation phase	Responsibility
i. Minimize erosional impacts during construction It is recommended that mitigation works involved with site clearance, slope reshaping, removal of rocks etc. are avoided during rainy season. Therefore, it is imperative that site works in upslope mitigation are carried out in the dry season and avoid such activities on upslope area in the wet season as much as possible. This should be considered in project planning stage. safety nets should be introduced to removal of rock boulders.	Site preparation & construction	Construction Contractor
ii. Invasive species Should be avoided in using vegetative erosion control structures. Native plants in the local environment should be chosen for vegetative control. The species used for vegetative control measures need approval from the Department of Wildlife Conservation & Department of Forest.	Construction	Construction Contractor

Impacts on transport infrastructure (especially temporary loss of road access, risks of traffic congestion) A good traffic control should be implemented in the construction stage. As there is a bend on the road and the tourist attractive water fall adjacent to the site proper road safety measures should be included with warning signs and permanent trained watchmen, luminous sign boards indicating slope instability risk and road obstruction signs, night lamps etc. are strongly recommended at this site.	Construction	Construction Contractor and
iii. Priority Health and Safety Issues As the workers in the site have to work in high risk conditions, it is imperative to implement recommendations given in section B of contractors' obligation on ESMP under "working conditions and community health and safety". These recommendations should be followed carefully in a proper organization and safety monitoring system. i. Prepare a special Occupational Health and Safety Management Plan prior to commencement of construction activities ii. A good warning system and full time watchman is highly recommended for this site for workers, tourists, businessmen and commuter safety. iii. Safety barriers and safety nets should be installed at places of risk to protect workers and commuters from boulder falling risk adoption of standard worker safety methods iv. Onsite sanitary facilities should be made available for the workers, and sanitary waste should be properly disposed v. Programs to inform and educate people in the vicinity about the risks posed by landslides vi. Requirement for special awareness for communities with potentially high risk during construction phase; short-term early warning measures (evacuation), and measures related to construction and land-use. vii. Programs to inform and educate people in the vicinity about the risks posed by landslides. viii. Requirement for special awareness for communities with potentially high risk during construction phase; short-term early warning measures (evacuation), and measures related to construction and land-use. ix. Provision of personal protective equipment (PPE) such as safety boots, helmets, protective clothing, goggles etc. x. Provision of training and awareness programs to employees xi. Conducting hazard analysis and plan/provide adequate mitigation measures for such hazards identified, prior to carrying out major construction activities xii. If the wasp nest is in the vicinity, it is mandatory to use Evacuation Centers for ensure of workers' safety xiii. Additionally, work should be discontinued for the sufficient time period during rainy period, during foggy times as working on unstable land will be highly risky in the rainy season xiv.	Construction	PMU Construction Contractor
iv. Safety especially in challenging weather conditions like fog **Visibility**: Ensure that all workers have high-visibility clothing and reflective gear. Use appropriate lighting and markers to make equipment and work zones visible. **Communication**: Maintain clear communication among team members. This is crucial in low visibility conditions. **Reduced speed for the vehicles**: Slow down equipment and vehicles to adjust for reduced visibility. Use fog lights and headlights, and	Construction	PMU Construction Contractor

maintain a safe following distance. **Warning signs**: Place warning signs and cones to alert approaching traffic and pedestrians to the construction site. **Alert on NBRO warnings** The occupants in the houses identified as high/medium risk and medium by the NBRO should be alerted on NBRO warnings during rainy days. Currently operating warning dissemination procedure should be strengthened to ensure that occupants are responsive on alerts. The Environmental and Social unit of PMU should take to step to implement response mechanism. **PPE**: Provide workers with fog-resistant safety goggles or face shields to maintain clear vision. Ensure workers wear appropriate respiratory protection if needed. **Non-slip footwear**: Ensure workers have proper footwear with good traction to prevent slips and falls on slippery surfaces. **Equipment maintenance**: Regularly check and maintain construction equipment, especially their lighting and safety features. **Weather updates**: Stay informed about changing weather conditions. Suspend work if fog becomes too dense or dangerous. **Training**: Train the team on fog-specific safety procedures and ensure they understand the importance of these precautions. **Emergency response**: Have a well-defined emergency plan in case of accidents or incidents during foggy conditions.		
v. Throw out disposals (litter, bottles, and food) to the construction site from the commuters. Put up the safety sign boards prior to the construction site indicating people at work. The commuters should be aware about the construction activities through notices erected before reaching the proposed mitigation site.	Site preparation & construction	Construction Contractor
vii. Injuries due to rock particles due to explosions/ blasting If rock blasting is needed, control blasting techniques with minimum explosives should be implemented by experienced personals or contractor. Otherwise the explosions may create further instabilities in the surrounding area. Minimize all blasting activities during peak times and making awareness announcements through the blasting period. Establish an emergency accidents preparedness plan for their injuries due to rock particles due to explosions/ blasting. A flagman / watcher should employ during rock blasting and to control vehicle movement. Safe use of rock blasting to be done to prevent accidents to workers	Construction	Construction Contractor
viii. Minimize erosional impacts during construction It is recommended that mitigation works involved with site clearance, slope reshaping, removal of rock boulders etc. are avoided during rainy season. Therefore, it is imperative that site works in slope mitigation are carried out in the dry season and avoid such activities on slope area in the wet season as much as possible. This should be considered in project planning stage.	Site preparation & construction	Construction Contractor

xv. Disposal of construction waste The contractor should pay special attention with respect to disposal of construction waste. This site is located close to a main road and a very attractive water fall with a pleasing environment. All of the tourists are stopped visit the waterfall during passing this area. Therefore, such waste if generated should store properly without getting washed off and dispose according to approved procedures by the PMU. Construction waste should not dispose along the road or into the drainages.	Site preparation & construction	Construction Contractor
xvi. Onsite sanitary facilities for the workers The contractor should prepare temporary sanitary facilities for the workforce within the site, to mitigate open defecation of the workers.	Site preparation & construction	Construction Contractor
xvii. Dust and aerosol control screens Dust particles generated during the construction period can influence the commuters and tourists. The commuters traveling in the this main road specially tourists could be affected from generated dust particles. Special screens etc. should be used if heavy dust or aerosol generating activities are envisaged.	Site preparation & construction	Construction Contractor
xviii. Water for construction Water for construction works should be obtained only from the approved sites.	Construction	Construction Contractor
xix. Working hours The construction activities should be restricted to day time only. Working after 6.p.m. is not recommended for any reason due to safety issues.	Construction	Construction Contractor
xx. Impact on service infrastructure Telecommunication, electricity, water lines should be relocated before construction starts as per the approval of PMU.	Construction	Construction Contractor
xxi. Need for people to enter or cross the site Possible unauthorized access to the site should be avoided by awareness, warning signs and vigilance by the contractor's full-time watchmen.	Construction	Construction Contractor
xxii. During construction good housekeeping should be maintained to minimize visual pollution	Site preparation & construction	Construction Contractor
xxiii. Worker's code of conduct Possible disputes between the labor force and the commuters and tourists should be prevented by maintaining the agreed code of conduct by the contractor. Possible disputes between workforce and commuters should be avoided especially when using shared resources such as common bathing and washing places etc.	Construction	Construction Contractor
xxiv. Snake bites, toxic insect bite management and emergency management by accidents Proper emergency management system for snake bites and toxic insect bite (include awareness on snake bites, safety shoes while at work, first aid on a snake bite, hospitalization and admission to correct hospital where snake bite management facilities are available) should be introduced. Accidents are common in these kinds of sites. Proper emergency management unit for other accidents (first aids facilities, safety items, hospitalization facilities and transportation facilities) should be maintained for this site.	Construction	Construction Contractor

10.7.3 Monitoring requirements specific to the site

Following monitoring plan is strongly emphasized during the construction phase specific to this site. In addition to this, monitoring procedure indicated in the contractors' obligation to ESMP should also be implemented by construction contractor. The contractor is expected to indicate in the bid the ESMP procedure to be implemented along with relevant proofs of his competency. The cost for ESMP will require to be indicated as a separate pay item. The environmental and social management method statement is expected to be submitted by the selected construction contractor and to be approved by the PMU unit.

Table 6: Environmental and Social monitoring plan; construction phase

Monitoring requirement	**Parameter**	**Frequency**
i. Baseline monitoring	Water quality	-
	Pre-construction crack survey of the site	-
	Ground vibration	Once*
	Air quality: particulate matter	Once*
	Background noise measurement	Once*
ii. During construction	Water quality	-
	Crack survey	-
	Ground vibration	During operation of drilling machinery, boring works, or any works that generate ground vibrations*
	Construction noise	Once a month during heavy noise generation times *
	Air quality particulate matter	Once a month *
iii. Vehicular Emission	All machinery/vehicles operational should have the emission control test certificate as applicable - should be checked by the site ES officer of the consultant	
iv. Monitoring agency	* A competent independent monitoring agency with registration of Central Environmental Authority for all parameters except crack surveys **Crack surveys should be conducted by competent agency acceptable to PMU	
v. Reporting requirements	**Stream water quality** – Comparison with National Environmental (ambient water quality) regulations, no.01 of 2019 **Pre-construction crack survey of the high-risk Buildings**-Professional report **Ground vibration**-as per the interim standards on vibration for the Machinery, Construction activities and Vehicular movements, CEA **Background noise measurement** –Extraordinary Gazette No.924.1, May 23,1996, CEA **Air quality particulate matter-** The National Ambient Air Quality standards stipulated under the Extraordinary Gazette, No. 1562/22 August 15, 2008 -Central Environmental Authority of Sri Lanka.	

11.Labour management

Sound worker-management relationships, treating workers in the project fairly and providing safe and healthy working conditions is required. Responsibility is lies with the PMU and the construction contractor.

The Objectives are;

- To promote safety and health at work.
- To promote the fair treatment, nondiscrimination and equal opportunity of project workers.
- To protect project workers, including vulnerable workers such as women, persons with disabilities, children and migrant workers, contracted workers, community workers and primary supply workers, as appropriate.
- To prevent the use of all forms of forced labor and child labor.

- To support the principles of freedom of association and collective bargaining of project workers in a manner consistent with national laws.
- To provide project workers with accessible means to raise workplace concerns.

12.Preventive measures for COVID-19 that was issued by Sri Lankan national health authority (this is applicable if Notification on Covid -19 epidemic/ endemic is issued by Health Authorities Sri Lanka)

COVID-19, the novel corona virus infection has not been totally eradicated in the world. Therefore, to prevent/ control of the spread of infection also to prevent panic situations in the event of detecting a suspected case, all contractors are required to develop a COVID-19 Preparedness plan and need implementing in the site as per the "Health and Safety Guidelines for Sri Lankan Construction Sites to be adopted during COVID 19 outbreak" Guidelines given by Construction Industry Development Authority CIDA 29th April 2020.

13.Public and Stakeholder Consultations -the public consultations that have been and/or will be held

13.1 Public Consultations

Consultations with the vendors engaged with the tourism near the Rawana water fall was held during the field visit. They stated that the mitigation works are appreciable and expressed their willingness to the project.

13.2 Stakeholders involved in the consultations any recommendations or agreements reached in the consultations (Refer Annexure II)

Mr. P.M. Indrajith, Technical Officer of the RDA-Bandarawela was informed as they are the stakeholders of this project.

14.Clearances, no objection, consent and approvals required for the implementation of the project

Table 7: Clearances, no objection, consent and approvals

Requirement / Approval / Institution	Relevance to the project
14.1 Project implementation	
Approval from the District Secretariat	The approvals will be required and the proposals need to be presented at the District Coordinating Committee, to which chief minister and stakeholder agencies in the district will also participate. The Officer of PMU will present the project, disclose the project details and various concerns including environmental and social issues will be discussed at this meeting. The issues arrived will be addressed in the ESMP, the decisions and recommendations taken up at this meeting will be considered in the ESMP.
Approval from the planning committee	The approval from the planning committee of the Ella Pradeshiya Sabha.
14.2 Approval from the state lands owners relevant to the project	
Central Environmental Authority	Consent from District Central Environmental Authority is required as Badulla District is under the sensitive area under Soil Conservation Act 25 of 1951.

Department of Forest Department of Wildlife Conservation	As there is no forest reservations and wildlife habitats; Department of Forest and Department of Wildlife Conservation approvals are not needed
Geological Surveys and Mines Bureau	Approval will be obtained for extraction of materials, transportation and disposal of earth, rocks and mineral debris. (If necessary, only).
Ella Divisional Secretariat	Approvals from Ella Divisional Secretariat will be obtained for the disposal of waste and plant litter.
Ceylon Electricity Board	Approvals from regional office of Ceylon Electricity Board will be required for power supply for site operation.
National Plant Quarantine Service	Approval from Additional Director National Plant Quarantine Service Katunayake for Director General of Agriculture under the Plant Protect Act No. 35 of 1999 Plant or seed if needed for bio–Project Managed slope mitigation shall be imported into Sri Lanka under the authority and in accordance with the conditions, of a plant importation permit issued.
14.3 Consent/ no objection/ legally bound agreement from the private land ownerships	
Land owner (RDA)	Signing a legally bound agreement between the land owner and the project implementing authority allowing no-objection to remove the structures, access the land, implement construction works, and engage in long-term maintenance works

The tentative timeline for getting approval is given in the table 8.

Table 8: Tentative timeline for getting approvals

Approvals	Month 1				Month 2			
	W1	W2	W3	W4	W1	W2	W3	W4
Project implementation ***Approval from the District Secretariat*** Submission of application Project briefing Respond to comments Approvals								
Approval from planning committee Submission of application Project briefing Respond to comments Approvals								
Approval from state land owners RDA Submission of application Respond to comments Approvals								
Other approvals GSMB Ministry of Defense (Depends on the requirement)								
Consent/ no objection from the land ownership								

15.Grievance redress mechanism for this site

The PMU ES officer is responsible for establishing the grievance redress mechanism for this site for impact communities. *(Reference: Environmental and Social Management Framework for recommended procedure for establishment of grievance redress mechanism).*

16.Information disclosure

It is the responsibility of the PMU to disclose the ES information to following agencies and organizations by indicated modes as a minimum as given in the following table.

Table 9: Proposed scheme of information disclosure

Information	Proposed agencies	Mode of information disclosure
i. Project plan (site details, design, implementation arrangements)	District CEA, District Secretariat, Divisional secretary, RDA, Other district levels Agencies, NBRO district office, AIIB	Meetings, District coordination committee, submission of relevant report to sign agreements, approvals and consents.
ii. Environmental and Social Management plan	District CEA, AIIB,	Meetings, District Coordination Committee, submission of relevant report to sign agreements, approvals and consents
iii. Monitoring reports (baseline and during construction)	District CEA, AIIB and relevant parties as appropriate	Progress meetings, special meetings, submission of relevant reports
iv. Site inspections for environmental conformance workers health and safety	District CEA, RDA, Divisional secretary, Police, State Land Owners, Grama Niladhari, District Office NBRO, AIIB and relevant parties as appropriate	Written and verbal communications, submission of relevant reports
v. Decisions taken and progress review meetings pertinent to ES matters	District CEA, RDA, Divisional secretary, Police, State Land Owners, Grama Niladhari, District Office NBRO, AIIB and relevant parties as appropriate	Meetings, submission of relevant reports
vi. Grievance redress mechanism	Relevant parties, AIIB	Meetings, written and verbal communications

Table 10: Level of information gathered through consulting institutions

Date	Institution	Person contacted for information
12/11/2024	RDA office - Bandarawela	Mr. P.M. Indrajith, Technical Officer
02/01/2025 (Over the phone)	District Secretariat office, Welimada	Ms. Y. M. Podimanike Gramaniladari 69S, Rawana Ella

Annexure I: Images of the site condition and the consultation

Consultation with Mr. P.M. Indrajith, Technical officer of RDA- Bandarawela

Annexure II: Report on the Stakeholder Consultation: Badulla District

Institution	Name and designation of the contact officer	Concerns raised
Central Environmental Authority	Provincial Director, Central Environmental Authority Central Province.	✓ Under the Soil Conservation Act 25 of 1951 of National Resource Management Centre, Badulla District has been gazetted as a sensitive area. ✓ Under this gazette any development is not allowed irrespective of the magnitude of the project. ✓ In a disaster this is not needed. ✓ Landslide mitigation projects are not considered projects prescribed in the Gazette. ✓ The Basic Information Questionnaire (BIQ) is needed to fill for the project and submit the application ✓ As the proposed project (mitigation) intends to reduce the risk from landslide for an emergency action CEA approval is not needed considering the priority of the project. ✓ Before project commence a request indicating the mitigation sites need. ✓ If the project is carried out in a sensitive area, even not within a prescribed project, consideration of sensitive area will govern the process.
Road Development Authority	Chief Engineer	✓ This area is under the jurisdiction of Bandarawela RDA office ✓ The RDA has no objection and states the mitigation is very much needed. ✓ Other concerns raised • A proper handing over of the project is required after the mitigation • RDA will do the maintenance after mitigation • It is emphasized that during the construction the contractor should use Personal Protective Equipment • At all times, the contractor shall provide safe and convenient passage for vehicles, pedestrians, and traffic safety measures, barricades, flagmen and for the night work, lights and illumination should be provided. ✓ It is also stated that Construction waste/ excavated materials should not be a nuisance to public/commuters

Annexure III: Proposed procedure for obtaining approvals from state land owners and environmental agencies.

1. **Proposed procedure by RDA for approval for implementation of landslide mitigation projects in RDA reservation areas**
   i. The design to be accepted by the RDA: The project implementing agency should submit detailed design report to RDA with a formal request on nature of approvals required. PMU should prepare above documents and should submit the documents to RDA regional office.
   ii. RDA regional office will evaluate the proposal and may call for project briefing. The PMU should provide necessary briefing as appropriate
   iii. On the approval by RDA an agreement will be signed between RDA and Project implementing agency to access the site, erect structures, and implement mitigation works.
   iv. A condition that would include is
      - A proper handing over of the project is required after the mitigation
      - RDA will do the maintenance after mitigation
      - It is emphasized that during the construction the contractor should use Personal Protective Equipment
      - At all times, the contractor shall provide safe and convenient passage for vehicles, pedestrians, and traffic safety measures, barricades, flagmen and for the night work, lights and illumination should be provided.
      - Construction waste/ excavated materials should not be a nuisance to public/commuters

Annexure IV: Study team

Name	Designation	Position in the study
SAMS Dissanayake	Senior Scientist/ESSD/NBRO	Senior Environmental Scientist
Prabath Liyanaarachchi	Scientist/ ESSD/NBRO	Environmental scientist, GIS/ Demographic data collection /survey, Report preparation
Ranil Jayawardhana	Field Assistant	Assistant - data collection for the SSESMP

Annexure: List of references

1. Contractor's obligations for Generic Environmental and Social Management Plan- Sri Lanka Landslide Mitigation Project-AIIB
2. Environmental and Social Management Framework-Sri Lanka Landslide Mitigation Project - AIIB
3. Resettlement Planning Framework- Sri Lanka Landslide Mitigation Project -AIIB
4. Felling Trees (Control) Act by Ministry of Agriculture, Rural Economic Affairs, Livestock Development, Irrigation and Fisheries and Aquatic Resources Development
5. Census and Statistical Report (2012), Department of Census and Statistics