Site Specific Environmental and Social Management Plan (SSE & SMP)

Site No.16
Ketendola, Ratnapura District - Package 1

August 2018

Prepared for:

Sri Lanka Landslide Mitigation Project
Asia Infrastructure Investment Bank
(AIIB)

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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
E & S & H & S unit of PMU	Environmental & Social & Health & Safety Unit of Project Management Unit
ESMF	Environmental and Social Management Framework
ESMP	Environmental Social Management Plan
SSE & SMP	Site Specific Environmental and Social Management Plan
GN	Grama Niladhari
GOSL	Government of Sri Lanka
GSMB	Geological & Mines Bureau
LRC	Land Reforms Commission
NBRO	National Building Research Organization
RDA	Road Development Authority

1. Introduction

The Government of Sri Lanka intends obtaining a loan from the Asian Infrastructure Investment Bank (AIIB) for mitigating/rectifying unstable slopes in high risk areas especially in 11 districts of 06 provinces of the country. 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 has been (ESMF) 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 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 minimum.

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 a 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 Ketendola landslide mitigation site. The 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 regulation and procedures to be followed during project implementation specific to the site

2. Location details and site description

Site reference: Site No.16 package-1, Ratnapura District, Ketendola

Site Details

The site falls administratively under Thiriwanaketiya Grama Niladhari Division (GN division) of Ratnapura Divisional Secretariat Division (DS Division), Ratnapura District of Sabaragamuwa Province. The moving ground section is located between Culvert 105/3 and 105/4 Colombo-Batticaloa A4 road (Ratnapura- Pelmadulla section) at Ketandola. The affected slow moving section of slope is bordered by Ratnapura - Pelmadulla Road from North and a natural stream from South.

i. The nearest town to the site is Ratnapura, about 5 km from the site.
ii. GPS reference of the site is 6 .664184 N, 80 .436953 E.: Ref. Map of the location Fig 1.
iii. The land ownership is Road Development Authority (RDA) reservation and a private land belongs to Mr. Asanka Chamara Liyanage.

Fig 1: Google image of the proposed land slide mitigation site and surrounding environmental features and service infrastructure. Ref. drone image for details- Annexure I

3. Landslide hazard incident details

On 26.05.2017, a precipitation of >300 mm had triggered the movement of the slope. The main cause of the slope movement is poor drainage management resulted during the road expansion activity, where adequate provision has not been made to convey runoff across the road and to the nearby culvert. This has resulted excessive seepage of water through the soil creating conditions favorable for progressive movement of slope towards the toe area (creep). Total area affected by the landslide is about 6700 m^2.

The crown of the creeped section is at 105/3 culvert of Colombo – Batticaloa A4 road (Ratnapura - Pelmadulla section). The movement has subsided a section of the road and down slope of about 4 feet while creating a long tension crack parallel to the road. The unstable section is a curve and runs up to the stream situated in the toe area which flows parallel to the road (fig 3). The creeping slope has created cracks of varying degree in the nearby buildings and structures located on the moving slope.

The damages occurred due to incident

Among the damaged structures, the house of Mr Asnaka Chamara Liyanage has been damaged beyond renovation. Cracks appeared in other 3 houses identified as high risk are; houses of Ms Umma Sadeena, Mr ML Nazeer and Mr Safwan.

The incident has no casualties as the movement of the slope was slow. During the incident the occupants in the damaged house had evacuated immediately. The occupant in the completely damaged house has been running a retail shop and this shop is abandoned since the incident.

The hazard has caused damage to one side of the road resulting part of the road to closure. During the incident, the damaged road had obstructed the traffic fleet, cutting- off of access to houses, community services (schools, community center, health care, religious places etc.). No significant crop/ agricultural lands damaged due to the incident. Ref. *Fig 2: Images of the project area.*

<table>
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<tr><td>Fig 2a: Damaged road due to the creeping slope</td><td>Fig 2b: RDA remediation works on the already moved downslope (09-08-02018)</td></tr>
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<tr><td>Fig 2c: The runoff of the upslope has been converted to community bathing place (observe the high runoff flow in normal conditions)</td><td>Fig 2d: Damaged road section and subsided downslope due to slope movement</td></tr>
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Fig 2: Images of the project area

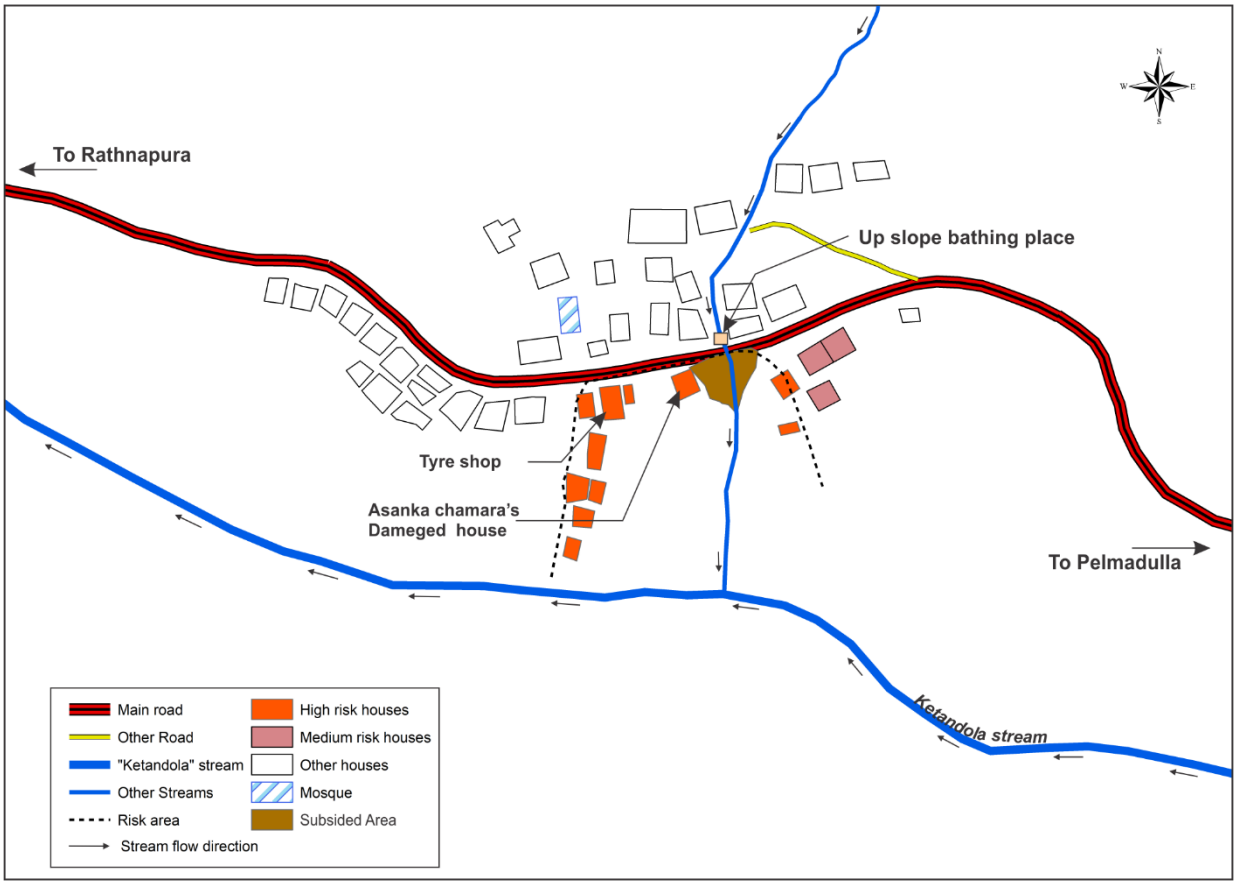

Fig 3: Diagrammatic interpretation of affected slope area and buildings due to ground movement

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

Upon the incident, the NBRO team has inspected the site and given immediate remediation to improve the surface drainage conditions by cutting down the seepage across the moving slope section and directing the runoff in to nearby culvert. The tension cracks on the ground were marked to demarcate the hazard zone and the houses at risk. The occupants including the GN officer have been alerted on the risk. The cracks on the houses were also monitored by measurement indicators. The remediation has resulted notable improvement to stability, but not completely.

Evacuations: The occupant of the damaged house Mr Asanaka Chamara Liyanage had already evacuated the house; he has lost the house and the retail shopping activity since 2017. Other families in 3 houses were categorised as high risk and had been informed to evacuate the houses. One of the house owners runs a tyre shop and still continuing the activity. The government has offered them a subsidiary type resettlement package to a value of LKR 1.6 million. All risk families have turned down the offer indicating the inadequacy of the amount to purchase a land and a house or to build a house. The consultation of the affected families indicated that the lands and houses cannot be purchased in the proximity with convenient access to the services within the given compensation. And also, evacuation will result complete loss to their current livelihood activities linked to the location according to them.

5. Description of the area of the landslide and areas adjacent to the landslide and current level of risk

The area of the landslide and adjacent areas to the landslide are partly RDA road reservation and private lands. Due to this hazard the houses belong to following named owners are at high risk; Mr Asanka Chamara Liyanage, Ms Umma Sadeena, Mr ML Nazeer, Mr Safwan. (Ref. Report No. NBRO/313500/06/RDO (L1)/17/074)

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

No forested areas, wild life reservations, environmentally sensitive habitats found within the study area. No ecologically significant habitats found. The terrestrial ecology represents mostly lowland rainforest vegetation. But the natural ecology of the area is greatly disturbed and displaced by trees cultivated at home gardens. Present land uses in the downslope of the moving slope is largely home gardens with high density of trees. Home gardens with houses are found in the upper slope area also a mosque is located opposite side of the slide at the upper slope area. A natural stream runs downslope parallel to the road. The elements and services at risk during the project implementation are:

i. Road traffic and commuters of the road and pedestrians
ii. Occupants of the houses alongside of the road
iii. The lands of the owners in the construction area
iv. Current economic activities the project influence area
v. Mosque and its religious activities
vi. Potable water supply lines crossing the damaged section of the slope supplying water to community of about 30 -50 families (Information source: the residents in the area)
vii. Ketendola; stream and its water flow and the quality

7. Description of the works envisaged under the project

The proposed mitigation works will be largely concentrated on the improvement to the drainage. Which will include permanent structures to convey the runoff through proper drainage management and directing the runoff to nearby culvert by a surface drain system. Lowering the water table in the unstable seepage area by insertion of horizontal drainage systems coupled with vertical drainage wells will also include into subsurface drainage systems. Reinforcing the weak embankments of the road section and toe area with gabion structures and etc. will be considered to strengthen the stability of the slope.

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

8.1 Positive impacts

The mitigation will make currently unstable lands and the road section stable, securing safety of the houses, structures and the occupants. The road will become stable, with low traffic jams and congestions as both sides can be opened permanently. Road closure will not result in the rainy period resulting good connectivity between the cities.

8.2 Negative impacts

The mitigation works are generally confined to an area which is already disturbed by a slope failure. Therefore, negative impacts are much localized and also limited mostly to construction period.

8.2.1 Loosing access to land and future development activities

Most of the mitigation works will be carried out in the road reservation and the land of Mr Asanka Chamara. Currently the land of Mr Asanka Chamara Liyanage is abandoned. Considering the risk the NBRO has advised him not to develop the land or erect structures in future. As a result, he will lose future development opportunity of his property. As the land has been already become unusable for any productive purpose due to hazard event he has been offered a compensation of 1.6 m LKR which has been turned down by him. As the project site is now a land which has been already considered as no-development zone there will be no provisions under the project to pay compensation to him. Also, under the project the land will not be acquired. Therefore, it may be reasonable to state that the project will not result loss to the landownership. However, the land owner may be allowed for non-destructive land uses, extract the products from the land use and etc. He can have access to land but any future development activities on the land will not be allowed.

During the land clearing the damaged house of Mr Asanka Chamara may be demolished and removed. There may be valuable building materials that can be recovered. If demolition takes place without recovering these materials, owner may lose the valuable building materials that can be recovered.

8.2.2 Ecological, biological impacts, and fauna and flora

The impacts on terrestrial ecosystems are localized. Impact on fauna and flora, degradation of sensitive ecosystems, large scale habitat fragmentation is minimal due to the project. Majority of the trees found in the site are not endemic, threatened and identified in the red data list of IUCN. There will be no incidence on poaching, extraction of protected trees etc.

During the project implementation there will be requirement of cutting/ uprooting of trees. In such cases necessary approval should be required. Riparian vegetation strips in some locations may require clearing. Also, in some places, relatively large patches of vegetation will be cleared. This may result some habitat fragmentation. Locally significant impacts may occur. Valuable timber species may be removed from the system unintentionally if proper supervision is not done by the Environmental and Safety Officer with relevant knowledge on these species.

8.2.3 Impact on the drainage pattern of the area

Disruption of existing surface and sub-surface drainage pattern in the area is envisaged during the construction period due to diversions of drainage. Incidences of water logging or localized flooding are anticipated due to the blockage to the existing flow paths during construction stage (due to diversions/blockage during construction of horizontal and cut-off drains, stockpiling of soils/construction materials, etc.) and also due to the sub surface excavations in rainy season.

8.2.4 Erosional impacts and stream bed alterations

The mitigation works in this project will focus largely on the drainage improvement. Therefore, during rainy season heavy flow of water is expected to enter the natural stream either through a culvert or directly to the streams through step drains etc**.** This will result increased stream discharge causing stream bank erosion, stream bed scouring, and increased river load. The impacts on environmental flow and aquatic ecosystems will be locally significant.

8.2.5 Water pollution impacts from construction activities

Washout of fines, sedimentation to existing watercourses and siltation in the downstream channels can be expected during the removal of debris, soil produced during the process of drilling and boring, landscaping/reshaping of slopes and etc. Improper disposal of oils and other harmful substances/contaminants from machineries, leakages from temporary storage tanks, solid waste and wastewater disposal/dumping from workers' sites could occur causing adverse impacts on water quality of the stream. Mixing of construction materials including cements/other grout materials used for soil strengthening with surface water flows will cause temporary water quality degradation and accumulation of unwanted substances in the downstream.

8.2.6 Open defecation and waterborne infections spread during construction phase

Faecal contamination of down slope water stream can be expected during construction due to open defecation by contractor's labour force.

8.2.7 Impacts on the downstream water uses

The construction activities may increase the pollution load in the streams with high Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Suspended Solids, Oils and Greases etc. The emissions will exceed the ambient water quality standards prescribed for designated uses such as drinking, bathing, and aquaculture and may violate even the minimum standards for water quality. This will make

water unsuitable for human use and aquatic life. The water quality impacts from discharge of wastewater and pollutants to environment during construction phase. Therefore it is highly significant**.**

8.2.8 Solid waste disposal issues

Haphazard disposal of Solid waste can pollute water and soil, and leave various environmental impacts if proper disposal mechanism is not in place during the construction period. The effect is significant unless a proper solid waste disposal mechanism is used during the construction period.

8.2.9 Air pollution impacts

Construction activities that contribute to air pollution include: land clearing, operation of diesel engines, demolition, burning, from storage, transportation, disposal of construction materials, construction waste and working with toxic materials (blasting chemicals). During construction, it will generate high levels of dust, typically from concrete, cement, wood, stone, and silica.

8.2.10 Noise pollution, vibration, blasting, impacts during construction, potential damage to buildings, infrastructure

Noise and vibration is expected from construction equipment. Noise impact is significant as there are buildings with occupants living closes to the site; within 100m from the site. Hence the project will have impacts on neighboring community.

A mosque is also located closes to the site. There will be significant impact on Fridays for devotees where the religious activities are carried out. Vibration can affect the stability of already cracked buildings during construction.

8.2.11 Relations between workers and the people living in the vicinity of the site and possibility of disputes

There may be disputes with the workers of construction site and the villagers as the people are living nearby.

8.2.12 Work camps and lay-down sites requirement

The solid waste and sewage removal in the camp if not properly designed will be a nuisance to the surrounding community. Proper closure of labour camps is also needed after the project before making it a trouble to neighbours.

8.2.13 Risks of public accessing the site during construction

The site may have machinery with high hazard risk such as drilling, boring and excavation machines etc. Only skilled workforce will be safe working in this environment. If unauthorized persons access the site, there may be a risk of being subjected to accidents by the heavy machinery.

8.2.14 Explosive hazards and hazardous materials

This project will not envisage rock blasting**.**

8.2.15 Road traffic and safety to the public from construction activities: risk for commuters

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 pedestrian passage and may pose high risk on their life.

8.2.16 Workers safety during construction

As the heavy construction machinery may be used in limited work spaces, risk of hazard from vehicle and construction machinery accidents is highly significant. Contractor may engage under age workers (children) for construction work, which is risky results serious accidents and injuries.

9. Public and stakeholder consultations that have been held and/or will be held

Following people who were the occupants of high risk buildings were consulted during field visit; Mr Asanka Chamara Liyanage, Ms Umma Sadeena, Mr. ML Nazeer. According to these people resettlement will result long-term hardship and dissatisfaction for the affected communities and persons. The people are of the opinion that the package of 1.6 M is a very small amount for them. Shifting to another place would affect their carrier, schooling and other livelihood activities. Hence people expressed their disagreement. (Ref: Annexure II: Images of the site condition and the consultation.).

9.1 Stakeholders involved in the consultations any recommendations or agreements reached in the consultations (Ref: annexure III)

10. Significant Environmental and Social Issues

Social or Environmental impacts or risks that will require special measures on the part of NBRO and the contractor; Indicative significant impacts

10.1 Impacts on water or wetlands (issues relating to changes or contamination of streams, rivers and other bodies of water, typically downstream from the site). This includes long-term impacts and potential impacts and risks during construction/remediation of the landslide site:

Washout of fines, sedimentation in existing watercourses and siltation in the downstream channels can be expected during the removal of debris and soil produced during the process of landscaping/reshaping of slopes. Improper disposal of oils and other harmful substances/contaminants from machineries, leakages from temporary storage tanks, solid waste and wastewater disposal/dumping from workers sites could occur causing adverse impacts on surface quality of the stream running at the landslide toe area.

10.2 Erosional impacts and stream bed alterations

The impacts on environmental flow, stream banks/ bed and aquatic ecosystems will be locally significant.

10.3 Impacts on transport infrastructure (especially temporary loss of road or rail access, 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, (in morning, day time and evening). This will cause nuisance to pedestrians and commuters.

10.4 Impacts on downstream service provision (water supply, sewerage, electricity, etc.)

The community water supply lines cross the sections of slope under mitigation. The construction works, moving machinery will certainly damage these lines. These water lines are community water supply lines providing water to about 30-50 families.

10.5 Households living in high-risk or medium-risk areas adjacent or near to the site (up-slope, down-slope, downstream, etc.)

The construction poses high risk on public safety, noise and vibration impacts, and cracks in buildings of the houses previously demarcated as high risk.

10.6 Areas used for businesses, agriculture or other within the area to be remediate

There are no areas used for business, specific agriculture practices or other immediately adjacent to the site hence has no significant impact.

10.7 Areas used for businesses, agriculture or other immediately to the site

The construction will result obstruction to business in the current tyre shop

10.8 Need for people to enter or cross the site

There is no special need for people to enter the site for other purposes. However, unauthorised entry of people may occur due to intentional or unintentional purposes, they may be at risk from operating machinery, and vehicles, electricity, and may be blasting materials.

10.9 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 largely common to any landslide mitigation site. 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.

10.10 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.

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

11.1 Project implementation

i. Approval from the District Secretariat
   The approvals will require to be obtained from the District secretary for the implementation of project where 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. The issues will be discussed, the recommendation proposed at this meeting will be considered in the implementation of the ESMP
ii. Approval from the planning committee
   The project will obtain the approval from the planning committee of the Ratnapura Urban council

11.2 Approval from sate land owners to implement the project in state lands of the site

i. The relevant agency is RDA as part of the project actions are taking place on the road reservation. Necessary agreements will be made between NBRO and the RDA to access the land, carry out construction work, remove materials (trees, soils, rocks and boulders), erect structures, and continue with operation and maintenance works.
ii. Approvals from regional office of Ceylon Electricity Board will be required for power supply for site operation.

11.3 Approval from environmental authority, Department of Forest, Department of Wildlife Conservation

i. As project site is located in an environmentally sensitive area approval from the district Central Environmental Authority is required. (refer Annexure IV. for the procedure)
ii. Also, the project actions may involve removal of protected tree species. Approvals from the Forest Department through Divisional Secretary will be obtained for the removal of protected trees

11.4 Other approvals

i. Approval from regional Geological Surveys and Mines Bureau will be obtained for transportation and disposal of earth, rocks and mineral debris.
ii. Approval for extraction of materials - Approval from Geological & Mines Bureau (GSMB) is needed (if necessary only).
iii. Approvals from Ratnapura Urban Council will be obtained for the disposal of waste and plant litter
iv. Approval through the Divisional Secretory from the district office of Ministry of Defense will be obtained for the sites if requiring rock blasting

11.5 Consent/ no objection/ legally bound agreements from the private land ownerships

i. A legally bound agreement between the land owner Mr Asanka Chamara and the project implementing authority will be signed allowing no-objection to remove the structures, access the land, implement construction works, and engage in long-term maintenance works
ii. There are water supply lines crossing the proposed mitigation area. And will be affected by the construction work. This will be informed to the vulnerable parties. Arrangements will be made to re-install them safely before project implementation under the project cost. The tentative timeline for getting approval is given in the table 1.

Table 1: 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 & CEB Submission of application Respond to comments Approvals								
Approval from DFC, DWLC Submission of application Respond to comments Approval								
Other approvals GSMB Ministry of Defense (Depends on the requirement)								
Consent/ no objection from the private land ownership								

12. Environmental Social Management Plan (ESMP)

Measures to manage and or mitigate the impacts and risks, especially the impacts and risks identified in Sections 8 & 10. This will be included in the specific recommendations and requirements of the ESMP.

12.1 Resettlement action plan

Will not be applicable to this site as there is no project based resettlement. However, there are occupied houses in the hazard zone instructed to evacuate, but continue living in the same location. These houses may have some impacts in the form of structural damage during the project actions due to ground vibration induced by heavy machinery operation. (A scheme of compensation, in case of damage to structures due to project should be arranged, (Refer 2002.2 17- utilities and roadside amenities in contractor's requirement to ESMP.

12.2 Evacuation of people: arrangements to move people from the site or areas immediately adjacent to the site, or from high-risk areas up-slope/down-slope or downstream from the site

This risk may not be triggered in this site.

12.3 Procedure for removal of damaged structures, facilities infrastructure

Project planning should consider to avoid intervening with house of Mr.Asanka Chamara as much as possible. The built house even if damaged should not be removed without full approval of the owner. In-depth consultation should be done to get the landowner agreed for this. He may consider removal of the structure at the project cost as it has no future value. But, signing a legally bound agreement between the land owner Mr. Asanka Chamara and the project implementing authority allowing no-objection to remove the structures is mandatory. During this process following is recommended as a minimum.

i. Thorough consultation with the land owner to get his consent
ii. Allow land owner to extract/ or extraction by the contractor on behalf of the land owner any valuable items from the structures
iii. Project bear the cost of removal of the structures
iv. If damage to water supply lines occurred alternative water supply or compensation for loss should be arranged.

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

May be triggered if project based cracks occur in the risk houses. The project should have an arrangement to pay compensation to the affected parties based on a technical evaluation report.

12.5 Public awareness is and education- needed for following areas

i. Programs to inform and educate people in the vicinity about the risks posed by landslides and importance of mitigation risk.
ii. 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.

12.6 Design based environmental/ social management considerations

Following environmental and social design considerations are recommended for this depending on its environmental and social relevance.

Table 2: 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 should limit a minimum number of removal of tree species.	High

	Sufficient emphasis should be made to consider conservation of trees if important tree species are found	
ii.	**Habitat connectivity and animal trails** If large fraction of vegetation is required to be cleared in ecologically fragile habitats 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 impact are localized.	Low
iii.	**Conservation of water resources** This 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, even as drinking water.	low
iv.	**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. In such instances the design should include alternative source of water for the community (temporary/or permanent).	low
v.	**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. Service of landscape architect may be important for the design of suitable mitigation structures.	Low
vi.	**Consideration of green environmental features** As many of the mitigations 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, use of excavation materials for construction and etc. .	Moderate
vii.	**Workers/ commuters and community safety** Activation of slide may occur during construction phase and may pose threat to workers and commuters. Therefore design based safety consideration such as berms, safety nets etc. should be considered (permanent/temporary)	Moderate
viii.	**Erosion control structures** In drainage management, water is extracted and conveyed to nearby streams often through culverts. During rainy season the flow in these drainage structures can be significantly high and this may cause stream bed and bank 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. **A natural stream with potentially high aquatic diversity flows at the toe area of the failed slope.**	Very high
ix.	**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 etc. should be considered if drain water is expected to be directed to natural streams. The materials with high durability should be used for structures and should be chosen carefully so as to withstand local weather conditions. Designs should specially consider corrosion prevention techniques if steel structures are used and geotextiles if fine sediments are prone to enter sub drains.	Very high

12.7 Mitigation of impacts during the construction phase

12.7.1 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 and Health and Safety (ES & HS) management during the construction phase"*** to be included in construction contractors' bid document. The main sections are summarised below (Table 3) indicating the degree of relevancy for this site. For details, ESMP for construction contractors should be referred.

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 PM unit.

Table 3: Contractor requirement to comply with ES & HS

Reference No. as per construction contractors obligation to ESMP	**Item**	**Relevant to the project**
2002 Environmental and Social Monitoring		
2002.2 1)	Storage on site	Highly Relevant
2002.2 2)	Noise and Vibration	Highly relevant (noise and vibration)
2002.2 3)	Cracks and damages to the buildings	Highly relevant
2002.2 4)	Disposal of waste	Highly relevant (stream nearby)
2002.2 5)	Disposal of refuse	Highly relevant (stream / road reservation)
2002.2 6)	Dust control	Highly Relevant (commuters/ pedestrians/ houses)
2002.2 7)	Transport of Construction materials and waste	Relevant
2002.2 8)	Water	Highly relevant (stream nearby)
2002.2 9)	Flora and Fauna	Relevant
2002.2 10)	Physical and cultural resources	Highly relevant (mosque)
2002.2 11)	Soil Erosion	Highly relevant
2002.2 12)	Soil Contamination	Relevant
2002.2 13)	Borrowing Earth	Relevant
2002.2 14)	Quarry Operations	Not relevant
2002.2 15)	Maintenance vehicles and Machinery	Relevant
2002.2 16)	Disruption to public	Highly relevant(community nearby)
2002.2 17)	Utilities and roadside amenities	Highly relevant (road/ houses/community water supply)
2002.2 18)	Visual environment enhancement	Relevant (aesthetically sensitive road sections)
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	Optional
	Reporting and maintenance of records	Relevant

2003. Working Conditions and Community Health and Safety		
2003.2	Safety organization and communication	Relevant (unsafe slops/ commuters/ houses/ 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	Highly 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 in addition to general monitoring indicators requirements for ESMP.*
Reference: Contractors Obligation for implementation of ESMP

12.7.2 Site specific mitigation

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

Table 4: Site specific ES & HS mitigatory measures

Mitigation item	Project implementation phase	Responsibility
i. Community water supply The community water supply lines crossing the sections of slope under mitigation should be properly installed during the site preparation so that no damage to water lines occur during the construction phase. In case if a damage happens, provisions should be in place for immediate rectification	Site preparation and Construction	Construction Contractor
ii. Community washing and bathing point The community water supply point which is located opposite to the site should not be used for workers bathing and sanitary purposes without proper permission from the community and contractor should not use this water for construction works under any circumstances.	Construction	Construction Contractor
iii. Prayers time in mosque Special attention should be paid not to interfere with prayers on Fridays and days of special religious activities of the mosque. The Environmental and Social unit of Project Management Unit (PMU) should evaluate this situation and necessary arrangements should be made to minimize possible disputes that would arise.	Construction	Construction Contractor
iv. Disposal of construction waste Under any circumstance construction waste should not be released to the natural stream. Contractor should obtain the approval from the Ratnapura UC for disposal of solid waste at approved locations	Construction	Construction Contractor
v. Minimize erosional impacts during construction It is recommended that mitigation works involved with site clearance, slope reshaping, removal of debris etc. are avoided during rainy season.	Construction	Construction contractor
vi. Dust and aerosol control screens	Construction	Construction Contractor

Special screens etc. should be used if heavy dust or aerosol generating activities are envisaged		
vii. Water for construction Water for construction works should be obtained only from the approved sites	Construction	Construction contractor
viii. Households living in high-risk or medium-risk areas adjacent or near to the site (up-slope, down-slope, downstream, etc.) The high noise, vibration and air pollution activities during construction phase should be done respecting the national pollution control regulations. Operations of machinery in off time should be avoided. Meaningful consultation should be done with the occupants of the houses avoid any disputes that may arise during operation of heavy machinery in unavoidable circumstances.	Construction	Construction contractor
ix. Open defecation and littering The potential water/soil pollution issues will be mitigated by I. Awareness on water pollution and water borne infections, damage to downstream uses due to open deification II. Arrange toilet facilities for workers in the proximity of the site III. Vigilance and monitoring of worker mal sanitation practices IV. Punishment to worker violating the condition. Onsite sanitary facilities should be made available for the workers, and sanitary waste should be properly disposed	Site preparation & construction	Construction contractor
x. Impacts on transport infrastructure (especially temporary loss of road or rail access, risks of traffic congestion) A good traffic control should be in place following the contractors ESMP specific to this site. As there is bend on the road adjacent to the site proper road safety measures should be included with warning signs and permanent trained watchmen	Construction	Construction contractor
xi. 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 and impacts due to noise and vibration on wildlife	Construction	Construction contractor
xii. 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.		
xiii. The occupants in the houses identified as high risk 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.	Construction	E&SU of PMU
xiv. Removal of structures Require consent from the land owners for the site works.	Site preparation	E&SU of PMU

12.7.3 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.

Table 5: Environmental and Social monitoring plan; construction phase

Monitoring requirement	Parameters	Frequency
i. Baseline monitoring	Stream water quality Pre crack survey of the high risk houses Ground vibration Background noise measurement Air quality: particulate matter	Once *
ii. During construction	Stream water quality	During slope excavations, ground soil boring works (every month) *
	Crack survey of the high risk houses	If noticeable displacement is observed during construction **
	Ground vibration	During operation of drilling machinery, boring works, or any works that generate ground vibrations*
	Construction noise	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 ambient water quality standards published by the CEA, 2017 **Pre crack survey of the high risk houses**-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.	

13. Grievance redress mechanism for this site

The PMU ES officer is responsible for establishing the grievance redress mechanism for this site **with special consideration for following impact communities;** a) Mr Asanka Chamara **(**land owner) b) Regional RDA-Ratnapura Office) c) House Owners in High risk area d) The chief priest in the Mosque. *(Reference: Environmental and Social Management Framework for recommended procedure for establishment of grievance redress mechanism)*

14. 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 6: Proposed scheme of information disclosure

Information	Proposed agencies	Mode of information disclosure
i. Project plan (site details, design , implementation arrangements)	District CEA, DFC, DWLC, District Secretariat, Divisional secretary, RDA, State land owners, 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, DFC, DWLC, AIIB,	Meetings, District Coordination Committee, submission of relevant report to sign agreements, approvals and consents
iii. Monitoring reports (baseline and during construction)	District CEA, DFC, DWLC, 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, DFC, DWLC, 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 at the progress review meetings pertinent to ES matters	District CEA, DFC, DWLC, 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 7: Level of information gathered through consulting institutions

Date	**Institution**	**Person contacted for information**
08/08/ 2018 @ 10.30 hrs	Road Development Authority	Mr. WPGL Werajeewa –Executive Engineer
08/08/2018 @ 13.00 hrs	Forest Department	Mr Nimal S Dewage – Range Forest Officer
09/08/2018 @ 10.00 hrs	Central Environmental Authority	Mr.K G.D.N Kiriella Director –CEA Ratnapura District
09/08/2018 @ 13.00 hrs	Department of Wildlife & Conservation (DWLC)	Mr Manjula Vidyarathna / Wild Life Rangw Officer Ratnapura
09/08/2018 @ 14.00 hrs	Land Reforms Commission	MS. Dulmini Patabadiarachchi Staff Assistant

Annexure I: Drone image of the project area

Dotted line indicates the tentative risk area

Aannexure II: Images of the site condition and the consultation

Fig a: Mr. A.M. Safras ;Religious Representative of the AL Masjidur Rahmaniy mosque was made aware about the mitigation project by NBRO staff. (09-08-2018)

Fig b: Mr.Asanka Chamara was made aware about the mitigation work by NBRO staff (09-08-2018)

Fig c: Totally damaged house of – Mr Asnaka Chamara the house and the tension crack on the road

Fig d: Totally damaged house of Mr Asnaka Chamara

Fig e: Waterlines crossing the unstable section

Fig f: Damaged road section at subsided downslope due to slope movement

Annexure III: Report on the Stakeholder Consultation: Ratnapura District

Date: 08/08/2018 and 09/08/2018		
Institution	**Name and designation of the contact officer**	**Concerns raised**
Road Development Authority	Mr. WPGL Werajeewa – Executive Engineer	✓ This area is under the jurisdiction of Ratnapura-Awissawella RDA regional 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 emphasised 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
Forest Department	Mr Nimal S Dewage – Range Forest Officer	✓ The Forest Department has no objection on the project Following matters were emphasized. ✓ There are Forest reservation in the Ratnapura district. However, some large portions of land still remain without clear boundaries and many of them are under jurisdiction of LRC. Currently the surveying of forested area is in progress. ✓ However, all lands under forest, private or under LRC and any other if cleared require approval from Forest Department ✓ Private/LRC/Forest land require approval from forest Department for complete clearance of land as in the case of boundaries are still not clear. ✓ Role of Forest Department is that they examine the plot to be cleared, measure the breadth of trees to be removed and specific habitat significance of the area to be cleared. The plot will be surveyed by the FD and report will be submitted to Timber Cooperation. The tree can be cut by the contractor, however, removal will be done by the Timber cooperation. All trees dbh of > 18 cm will be taken by the Timber Cooperation. ✓ Regarding the project implementation, he said that mitigation proposal with draft layout should be submitted to Conservator Forest and approval to be obtained. ✓ This does not apply only forested areas but isolated any location in the proximity of forest ✓ As Ratnapura is having lot of forest areas, therefore project are required to obtain consent for project implementation with the services of conditions such as; • No entry of forest reserves, extraction of forest species, timber for project work, any other • Chemical blasting should be done in a manner not harmful to fauna • Structural mitigation measures should essentially followed environmentally friendly aesthetically comparable designs. • If plants are used for remediation prior approval should be obtained

		• Early informing the project, the Forest Department can support the project by providing good quality trees for planting. • Prior approval for suitable species for reforestation should be obtained from Forest Department. ✓ The Central Environmental Authority (CEA) will directly intervene for removal of forested area of > 1ha in the lands of LRC or private lands ✓ The Central Environmental Authority (CEA) and forest Department will intervene removal of forested area of < 1ha in the lands of LRC or private lands ✓ The clearance process may demand baseline studies for certain sites in which aquatic and terrestrial habitat surveys may be recommended. Similar reports may be demand by CEA during the project implementation.
Central Environmental Authority	Mr.K G.D.N Kiriella Director –CEA Ratnapura District	✓ Under the Soil conservation Act 772/22 of 1996. of National Resource Management Centre, Ratnapura District has been gazetted a sensitive area except the Embitipitiya area ✓ Under this gazette any development is not allowed irrespective of the magnitude of the project. ✓ In a disaster this is not needed. ✓ The Basic Information Questionnaire (BIQ) is needed to fill for the project and submit the application ✓ Since the waterway is located downslope in the area it is needed to keep the Environmental flow ✓ There may be endemic species, special habitats (niches) , fauna flora study are needed ✓ This Environmental assessment may be required to see their difference after mitigation ✓ The CEA will grant approval with recommendations.
09/08/2018		
Institution	**Name and designation of the contact officer**	**Concerns raised**
Department of Wildlife & Conservation (DWLC)	Mr Manjula Vidyarathna / Wild Life Rangw Officer Ratnapura	✓ No objection on the project ✓ A report to be submitted to DWLC for approval ✓ Removal of Fauna & Flora is needed under Wild Life Ordinance ✓ Removal of flora & fauna; endemic, threatened, identified under Red List needed approval from DWLC.
Land Reforms Commission	MS. Dulmini Patabadiarachchi Staff Assistant	✓ If the land tenure is Land Reforms Commission an approval should be requesting from Commissioner –Land Reforms Commission through a letter

Annexure IV: 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 conditions 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 emphasised 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

2. **Proposed approval procedure for Environmental Clearance form District Central Environmental Authority**
   i. In the project preparation phase, the ES & H&S unit of PMU study the Site specific ESMPs and should submit the project proposal to district office of CEA with details of the Arial extent that would be influenced by the project actions with spatial references to sections of site specific ESMP relevant to the project.
   ii. A basic information questioner (BIQ) should be completed and submitted along with the above details
   iii. CEA may call for project briefing and further information on ESMP that should be provided by the PMU
   iv. Approval will be granted subjected to site specific conditions that should be adhered by the project

Annexure V: Study team

Name	Designation	Position in the study
TDSV Dias	Director/ ESSD/NBRO	Team leader
SAMS Dissanayake	Senior Scientist/ESSD/NBRO	Senior Environmental Scientist
Prabath Liyanaarachchi	Scientist/ ESSD/NBRO	Environmental scientist
Abheetha Wanasundara	Officer in charge / Ratnapura District	Geotechnical Engineer
Indu Upamali	Scientist/ LRRMD/NBRO	Geologist
H Kusalasiri	Technical Officer/ESSD/NBRO	GIS/Demographic data /survey support

Annexure VI: List of references

1. NBRO site investigation report on landslide disaster at Ketendola – (Ref. Report No. NBRO/313500/06/RDO (L1)/17/074)
2. Contractor's obligations for Environmental and Social Management Plan- Sri Lanka Landslide Mitigation Project-AIIB
3. Environmental and Social Management Framework-Sri Lanka Landslide Mitigation Project _AIIB
4. Resettlement Planning Framework- Sri Lanka Landslide Mitigation Project _AIIB