スリランカ国
国家建築研究所

スリランカ国

土砂災害対策強化プロジェクト
【有償勘定技術支援】

プロジェクト完了報告書
添付資料（1/2）

平成30年9月
（2018年）

独立行政法人
国際協力機構（JICA）

株式会社 地球システム科学
日本工営株式会社

環 境
JR
18-113

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添付資料（1/2）

添付資料１　PDM 及び PO
添付資料２　業務フローチャート
添付資料３　詳細活動計画
添付資料４　専門家派遣実績（要員計画）
添付資料５　研修員受け入れ実績
添付資料６　供与機材・携行機材実績
添付資料７　合同調整会議議事録
　　7-1　第１回 JCC
　　7-2　第２回 JCC（中間評価）
　　7-3　第３回 JCC（終了時評価）
添付資料８　機材活用計画
添付資料９　その他活動実績
　　9-1　入札関連書類
　　9-2　Koslanda 地すべり調査報告
　　9-3　パイロットサイト概況調書
　　9-4　調査設計報告書

添付資料（2/2）

　　9-5　パイロットサイト工事完了報告書
　　9-6　工事完了証明書
　　9-7　瑕疵担保期間完了証明書
　　9-8　管理移譲に関するレター
　　9-9　土砂災害対策設計・施工マニュアル
　　9-10　パイロットサイトにおける活動報告
　　9-11　土地利用許可に関するレター
　　9-12　環境モニタリング報告書

添付資料　1

PDM 及び PO

Project Design Matrix: PDM (Version-2)

Project title: The Technical Cooperation for Landslide Mitigation Project
Project period: Four years (mid 2014 – mid 2018)
Target group: NBRO
Target area: Kandy, Matale, Nuwar Eliya and Badulla Districts

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal: Sediment disaster (landslide) in the target area is mitigated.	1. Number of sediment disaster events in the target area in 2017-2020	DesInventar data base on the number of sediment disaster s	
Project Purpose: Sediment disaster (landslide) management capacity of NBRO is improved through application of appropriate mitigation measure with Japanese and other technology in the pilot project sites.	1. Number of completed sediment disaster mitigation works designed, supervised and monitored by NBRO in the pilot areas in enhanced manners.	-Completion reports of sediment disaster mitigation measures in 2014-2017 -NBRO's Annual Report in 2014-2017	Government policy on NBRO's mandate is unchanged.
Output 1: Capacity of investigation, planning and evaluation for sediment disaster (landslide) mitigation measures is strengthened.	1-1 Number of reports on survey and evaluation for selection of sediment disaster(landslide) mitigation measures in the pilot areas 1-2 Number of reports on geological investigation 1-3 Number of reports on monitored data, analysis and evaluation for the pilot areas. 1-4 Number of reports on construction implementation plan utilizing air compressor for sediment disaster (landslide) mitigation measures	-Reports on survey and evaluation for selection of sediment disaster(landslide) mitigation measures in the pilot areas -Geological investigation report -Monthly report on monitoring data, analysis and evaluation result and maintenance -Result of examination conducted by the project -Report on construction implementation plan utilizing air compressor for sediment disaster (landslide) mitigation measures	NBRO coordinates all related government organization and other agencies and groups
Output 2: Capacity of design, construction supervision, and monitoring for landslide mitigation measure is strengthened.	2-1 Number of reports on NBRO' s activities for implementation of landslide measure work in a pilot area	-Completion Reports of sediment disaster(landslide) measure works in each pilot area	
Output 3: Capacity of design for slope failure mitigation measure is strengthened.	3-1 Number of reports on NBRO' s activities for implementation of slope failure measure work in a pilot area	-Tender Documents on respective measure work in sediment disaster measure works in the	

<table>
<tr><td>Output 4:
Capacity of design, construction supervision, and monitoring for rock fall mitigation measure is strengthened.</td><td>4-1 Number of reports on NBRO' s activities for implementation of rock fall measure work in a pilot area</td><td>pilot area

-Tender Evaluation Reports for respective sediment disaster measure work in the pilot area

-Reports of construction supervision of respective sediment disaster measure works in the pilot area</td><td rowspan="2"></td></tr>
<tr><td>Output 5:
Knowledge and know-how for landslide mitigation measures are improved.</td><td>5-1 Number of documents including technical standard and manual for design and construction supervision of sediment disaster(landslide) mitigation measures as well as materials on land use regulation, and early warning and risk information dissemination
5-2 Number of participants in seminars/workshops</td><td>-Completion reports of sediment disaster mitigation measures in 2014-2017
-NBRO's Annual Report in 2014-2017
-Project Progress Report</td></tr>
<tr><td>Activities
1.1 Conduct preliminary investigations on sediment disaster (landslide) in pilot areas.
1.2 Execute geological and geotechnical investigations at a candidate site in the pilot areas.
1.3 Install necessary monitoring equipment such as piezometers, extensometers, strain gauges with piezometer and inclinometer pipes.
1.4 Examine and determine the concept of sediment disaster (landslide) mitigation measures in pilot areas.
1.5 Procure air compressor and make construction implementation plan utilizing air compressor for sediment disaster (landslide) mitigation measures

2.1 Monitor and evaluate the landslides in the pilot areas.
2.2 Design and estimate construction cost for landslide mitigation measures in the pilot areas.
2.3 Prepare tender documents for landslide mitigation measures in the pilot areas.
2.4 Evaluate tender documents and procure contractor for landslide mitigation measures in the pilot areas.
2.5 Supervise the construction work for landslide mitigation measures in the pilot areas.</td><td colspan="2">Inputs
Japan side
1. Experts
(Long-term)
- Chief Adviser / Sediment Disaster Management Policy

(Short-term)
- Team Leader / Expert of Sediment Disaster (Landslide) Analysis
- Expert of Investigation & Monitoring
- Expert of Landslide Mitigation Measure (Design / Construction Supervision)
- Expert on Slope Failure Mitigation Measure (Design / Construction Supervision)
- Expert of Rock Fall Mitigation Measure (Design / Construction Supervision)
- Drilling Expert
- Expert of Procurement / Tender Evaluation
- Expert of Non-Structural Measures (Land Use and Early Warning)
- Project Coordinator / Landslide Mitigation Measure Assistant

2. Training in Japan / Third Country

Sri Lankan side
1. Counterpart personnel

2. Project office and facilities

3. Expenses
Running expenses necessary for the implementation of the Project</td><td>Counterparts who acquired skills through the project are not transferred

No catastrophic disaster will occur during project period.

No rapid change of natural environment

<u>Preconditions</u>
NBRO has appropriate budget for project management fund.</td></tr>
</table>

2.6 Prepare completion report of the landslide mitigation measures in the pilot areas including an evaluation on effectiveness of the measures. 3.1 Monitor and evaluate the slope failure in the pilot area. 3.2 Design and estimate construction cost for slope failure mitigation measure in the pilot area. 4.1 Monitor and evaluate the rock fall in the pilot area. 4.2 Design and estimate construction cost for rock fall mitigation measure in the pilot area. 4.3 Prepare tender documents for rock fall mitigation measure in the pilot area. 4.4 Evaluate tender documents and procure contractor for rock fall mitigation measure in the pilot area. 4.5 Supervise the construction work for rock fall mitigation measure in the pilot area. 4.6 Prepare completion report of the rock fall mitigation measure in the pilot area. 5.1 Review and update the existing guideline and technical manual on sediment disaster (landslide) mitigation on structural measures. 5.2 Conduct trainings using the revised guideline and technical manual on sediment disaster (landslide) mitigation on structural measures. 5.3 Conduct technical seminars and workshops on sediment disaster (landslide) mitigation for both structural and non-structural measures. 5.4 Stakeholder consultation on land use regulation for sediment disaster (landslide) mitigation. 5.5 Prepare materials on landuse regulation for sediment disaster (landslide) mitigation. 5.6 Stakeholder consultation on early warning and disseminating risk information for sediment disaster (landslide) mitigation based on the experiences in Japan. 5.7 Prepare materials on early warning and risk information dissemination for sediment disaster (landslide) mitigation based on the experiences in Japan.	3. Equipment - Desktop Computer - Laptop Computer(s) - Printer(s) - Piezomter (s) - Extensometer(s) - Strain gauge(s) with piezometer - Inclinometer pipe(s) - Equipment related to training - Other equipment mutually agreed upon as necessary for the implementation of the Project 4. Survey / Investigation - Topographic Survey - Geological investigation including drilling, geophysical survey and seismic exploration 5. Expenses Expenses necessary for the implementation of the Project		

Plan of Operation (Version-2)

	1st Year				2nd Year				3rd Year				4th Year			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
1.1 Conduct preliminary investigations on sediment disaster (landslide) in pilot areas.																
1.2 Execute geological and geotechnical investigations in the pilot areas.																
1.3 Install necessary monitoring equipment such as piezometers, extensometers, strain gauges with piezometer, inclinometer pipes.																
1.4 Examine and determine the concept of sediment disaster (landslide) mitigation measures in pilot areas.																
1.5 Procure air compressor and make construction implementation plan utilizing air compressor for sediment disaster (landslide) mitigation measures																
1.6 Monitor implementation of construction implementation plan																
2.1 Monitor and evaluate the landslides in the pilot areas.																
2.2 Design and estimate construction cost for landslide mitigation measures in the pilot areas.																
2.3 Prepare tender documents for landslide mitigation measures in the pilot areas																
2.4 Evaluate tender documents and procure contractor for landslide mitigation measures in the pilot areas.																
2.5 Supervise the construction work for landslide mitigation measures in the pilot areas.																
2.6 Prepare completion report of the landslide mitigation measures in the pilot areas including an evaluation on effectiveness of the measures.																
3.1 Monitor and evaluate the slope failure in the pilot area.																
3.2 Design and estimate construction cost for slope failure mitigation measure in the pilot area																
3.3 Prepare tender documents for slope failure mitigation measure in the pilot area																
3.4 Evaluate tender documents and procure contractor for slope failure mitigation measure in the pilot area																
3.5 Supervise the construction work for slope failure mitigation measure in the pilot area																
3.6 Prepare completion report of the slope failure mitigation measure in the pilot area																
4.1 Monitor and evaluate the rock fall in the pilot area																
4.2 Design and estimate construction cost for rock fall mitigation measure in the pilot area																
4.3 Prepare tender documents for rock fall mitigation measure in the pilot area																
4.4 Evaluate tender documents and procure contractor for rock fall mitigation measure in the pilot area																

Annex 3

	1st Year				2nd Year				3rd Year				4th Year			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
4.5 Supervise the construction work for rock fall mitigation measure in the pilot area																
4.6 Prepare completion report of the rock fall mitigation measure in the pilot area																
5.1 Review and update the existing manual and technical standard on sediment disaster (landslide) mitigation on structural measures																
5.2 Conduct trainings using the revised technical standard and manual on sediment disaster (landslide) mitigation on structural measures																
5.3 Conduct technical seminars and workshops on sediment disaster (landslide) mitigation for both structural and non-structural measures																
5.4 Discuss among stakeholders concerned on land-use regulation for sediment disaster (landslide) mitigation																
5.5 Prepare materials on land-use regulation for sediment disaster (landslide) mitigation																
5.6 Stakeholder consultation on early warning and disseminating risk information for sediment disaster (landslide) mitigation based on the experiences in Japan																
5.7 Prepare materials on early warning and risk information dissemination for sediment disaster (landslide) mitigation based on the experiences in Japan																

添付資料　2

業務フローチャート

年次

第１期　2014 年９月上旬～ 2016 年２月下旬

第２期　2016 年４月上旬～ 2018 年９月下旬

作業内容

国内作業

現地作業

【1】【2】既存資料・情報の収集・整理及び基本方針等の検討、ワークプラン（WP）及び技術移転計画の作成

【3】WP の提出・説明・協議

【4】ベースライン調査の実施

成果１

土砂災害対策のための調査、評価に係る能力が強化される

【5】パイロット地区での土砂災害についての予備調査・概査

【6】パイロット地区の候補地における測量、地質及び地質工学調査

【7】モニタリング機材の設置

【8】パイロット地区での土砂災害対策工の概念の考察・決定

パイロット事業入札・選定

成果２

地すべり対策の設計、施工監理及びモニタリング能力が強化される

モニタリング

【9】パイロット地区での地すべりのモニタリング及び評価

モニタリング継続

設計・積算

【10】パイロット地区での地すべり対策の設計、事業費積算及び入札図書の作成

成果３

斜面崩壊対策の設計、施工監理及びモニタリング能力が強化される

モニタリング

【11】パイロット地区での斜面崩壊のモニタリング及び評価

モニタリング継続

設計・積算

【12】パイロット地区での斜面崩壊対策の設計及び事業費積算

成果４

落石対策の設計、施工監理及びモニタリング能力が強化される

モニタリング

【13】パイロット地区での落石のモニタリング及び評価

モニタリング継続

設計・積算

【12】パイロット地区での落石対策の設計及び事業費積算

【21】パイロット地区での対策工のための入札書類の評価及び施工調達

成果５

土砂災害軽減対策（非構造物対策を含む）の知識とノウハウが改善される

【15】土砂災害の構造物対策についての既存ガイドライン・技術マニュアルの更新及び研修の実施

【16】土砂災害の構造物対策及び非構造物対策についてのセミナー及びワークショップの開催（ワークショップ△ 技術セミナー△ 各年１回）

【17】土砂災害軽減のための土地利用規制についての関係者協議及び資料の作成

【18】土砂災害軽減のための早期警報及びリスク情報伝達についての関係者協議及び資料の作成

※長期 / 短期専門家が中心となり実施

施工開始

竣工検査引き渡し

瑕疵検査

【22】パイロット地区での対策工の施工監理

地すべり対策工２ヶ所

ヌワラエリヤ（工期９ヶ月）

バドゥッラ（工期 16 ヶ月）

2017 年７月頃迄

【23】パイロット地区での対策工の完了報告書の作成

モニタリング継続

瑕疵担保期間（12 ヶ月）

※ 対策工に損傷があった場合

瑕疵に該当するか判断

修繕工事

【22】パイロット地区での対策工の施工監理

落石対策工

マタレ（工期 11 ヶ月）

2017 年
2 月頃迄

【23】パイロット地区での対策工の完了報告書の作成

モニタリング継続

瑕疵担保期間（12 ヶ月）

施工開始

竣工検査引き渡し

瑕疵検査

プロジェクト目標　パイロット地区でのスリランカに適用可能な日本の土砂災害軽減対策を通じてNBROの土砂災害管理能力が向上する

【27】成果モニタリングの実施

JCC　【28】機材調達

JCC　【28】機材調達　【29】中間レビューへの協力

JCC　【30】終了時評価への協力

本邦研修　【32】研修員受け入れに係る業務

【20】第１年次業務についての説明・協議

☆【31】プロジェクトの概要資料の改訂☆

本邦研修　【32】研修員受け入れに係る業務

報告書成果品

業務計画書 and ワークプラン

業務完了報告書（第１年次）

業務計画書

業務進捗報告書１

業務進捗報告書２

プロジェクト完了報告書（英文）

プロジェクト完了報告書（和文）

① 地すべり対策ガイドライン
② 地すべり対策技術マニュアル
③ 斜面崩壊対策ガイドライン
④ 斜面崩壊対策技術マニュアル
⑤ 落石対策ガイドライン
⑥ 落石対策技術マニュアル

添付資料　3

詳細活動計画

様式－2

■現地業務
□国内業務

第1期契約 / 第2期契約

9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11

2014年度 / 2015年度 / 2016年度 / 2017年度 / 2018年度

事前情報収集・W/Pの作成・ベースライン調査		
【1】	既存資料・情報の収集・整理及び基本方針等の検討	予定 / 実績
【2】	ワークプラン(W/P)及び技術移転計画の作成	予定 / 実績
【3】	W/Pの提出・説明・協議	予定 / 実績
【4】	ベースライン調査の実施	予定 / 実績
成果1：土砂災害対策のための調査・評価に係る能力が強化される		
【5】	パイロット地区での土砂災害についての予備調査・概査	予定 / 実績
【6】	パイロット地区の候補地における測量、地質及び地質工学調査	予定 / 実績
【7】	モニタリング機器の設置	予定 / 実績
【8】	パイロット地区での土砂災害対策工の概念の考察・決定	予定 / 実績
成果2：地すべり対策の設計、施工監理及びモニタリング能力が強化される		
【9】	パイロット地区での地すべりのモニタリング及び評価	予定 / 実績
【10】	パイロット地区での地すべり対策の設計、事業費積算及び入札図書の作成	予定 / 実績
【21】	パイロット地区での対策工のための入札書類の評価及び施工業者の調達	予定 / 実績
【22】	パイロット地区での対策工の施工監理	予定 / 実績
【23】	パイロット地区での対策工の完了報告書の作成	予定 / 実績
成果3：斜面崩壊対策の設計、施工監理及びモニタリング能力が強化される		
【11】	パイロット地区での斜面崩壊のモニタリング及び評価	予定 / 実績
【12】	パイロット地区での斜面崩壊対策の設計及び事業費積算	予定 / 実績
【21'】	パイロット地区での対策工のための入札書類の評価及び施工業者の調達	予定 / 実績
【22'】	パイロット地区での対策工の施工監理	予定 / 実績
【23'】	パイロット地区での対策工の完了報告書の作成	予定 / 実績
成果4：落石対策の設計、施工監理及びモニタリング能力が強化される		
【13】	パイロット地区での落石のモニタリング及び評価	予定 / 実績
【14】	パイロット地区での落石対策の設計及び事業費積算	予定 / 実績
【21''】	パイロット地区での対策工のための入札書類の評価及び施工業者の調達	予定 / 実績
【22''】	パイロット地区での対策工の施工監理	予定 / 実績
【23''】	パイロット地区での対策工の施工監理	予定 / 実績
成果5：土砂災害軽減対策(非構造物対策を含む)の知識とノウハウが改善される		
【15】	土砂災害の構造物対策についての既存ガイドライン・技術マニュアルの更新及び研修の実施	予定 / 実績
【16】	土砂災害の構造物対策及び非構造物対策についてのセミナー及びワークショップの開催	予定 / 実績
【17】	土砂災害軽減のための土地利用規制についての関係者協議及び資料の作成	予定 / 実績
【18】	土砂災害軽減のための早期警報及びリスク情報伝達についての関係者協議及び資料の作成	予定 / 実績
【28】	機材調達	
本邦研修など		
報告書など		

履行期限が2015年5月から2016年2月に変更

施工期間

瑕疵期間

Kandyはパイロット地区から除外することが決定された

長期/短期専門家の活動にあわせて臨機応変に対応

本邦研修△　本邦研修△　中間レビュー△　終了時評価△

△W/P　C/R△　△PR1　△PR2　FRE/J△

※W/P：ワークプラン　C/R業務完了報告書(1年次)　PR1/2：業務進捗報告書1・2　FRE/J：プロジェクト完了報告書(英文・和文)

添付資料　4

専門家派遣実績

要員計画

1．現地業務

氏名（担当業務）	格付		第1期（2014年度8月～2015年度3月）	第2期（2016年度4月～2018年度10月）	第1期 現地	第1期 国内	第2期 現地	第2期 国内	計 現地	計 国内
原　龍一（総括/土砂災害解析）	2	計画	(60) (60) (45)	(30) (15) (15) (15) (15) (15) (37) (45) (15)	5.50		6.73		12.23	
		実績	10/1-11/29 (60) 1/7-3/13 (60+6) 5/30-8/3 (45+21)	4/12-5/11 (30) 7/9-7/23 (15) 9/10-9/24 (15) (14) 10/9-10/22 1/28-2/12 (16) 5/13-5/27 (15) 6/6-6/17 (12) 9/14-10/19 (36) 12/2-12/16 (15) 1/15-1/29 (15) 2/22-4/7 (45) 7/9-7/29 (20)	6.40		8.27		14.67	
大河原　彰（地すべり対策（設計・施工監理））	3	計画	(30) (30) (45)	(30) (15) (15) (15) (30) (15) (30) (15) (15)	3.50		6.30		9.80	
		実績	10/31-11/29 (30) 1/26-2/27 (30+3) 5/30-8/3 (45+21)	4/12-5/20 (30+9) 6/11-6/25 (15) 11/10-11/24 (15) 12/5-12/19 (15) 7/17-8/5 (20) 7/14-7/29 (16)	4.30		4.00		8.30	
川上　京一（斜面崩壊対策（設計・施工監理））	3	計画	(40) (30) (35)	(15) (15) (15) (15) (15) (15) (15) (15) (15) (29) (15)	3.50		5.97		9.47	
		実績	10/1-11/29 (20+40) 1/7-3/4 (60) 3/29-4/11 (8+6) 11/28-12/10 (13) 1/3-1/20 (18)	4/3-4/24 (21) 8/14-8/28 (15) 1/9-23 (15) 2/9-23 (15) 3/9-23 (15) 4/15-29 (15) 2/22-3/21 (28) 7/5-7/22 (18)	4.53		4.77		9.30	
西川　知行（モニタリング機器/地質）	5	計画	(30) (45)	(24) (15) (15)	3.00		1.80		4.80	
		実績	11/25-12/14 (30) 5/22-7/5 (45)	4/18-5/11 (24) 9/10-9/24 (15) 3/24-4/7 (15) 5/12-5/31 (20) 6/17-7/1 (15) 7/16-7/29 (14)	2.50		3.43		5.93	
荻野　隆（落石対策（設計・施工監理））	5	計画	(30) (60) うち15日を国内に振替	(15) (15) (15) (15) (15) (15)	3.00		3.00		6.00	
		実績	10/31-11/29 (30) 5/30-8/3 (60+6)	4/28-5/11 (14) 9/10-9/24 (15) 2/9-2/23 (15) 10/5-10/19 (15) 5/12-5/27 (16) 7/8-7/22 (15)	3.20		3.00		6.20	
楊　普才（ボーリング技術）	5	計画	(30) (105)	(15)	4.50		0.50		5.00	
		実績	10/31-11/29 (30) 1/27-5/11 (105)	5/25-6/8 (15)	4.50		0.50		5.00	
鵜澤　幸二（調達/入札評価）	5	計画	(30) (15)	(27)	1.50		0.90		2.40	
		実績	10/31-11/29 (30) 5/9-5/23 (15) 8/24-9/24 (30) 11/14-11/21 (13)	7/9-8/4 (27)	2.83		0.90		3.73	
小池　徹（地すべり対策（リスク評価））	5	計画	(15) (15) 6日分を川上に振替	(15) (7) (15)	1.00		1.23		2.23	
		実績	1/13-2/5 (24)	2/15-3/1 (15) 3/18-3/24 (7) 7/30-8/10 (12)	0.80		1.13		1.93	
和田　知之（地形解析）	5	計画	(30)		1.00		0.00		1.00	
		実績	10/18-11/16 (30)		1.00		0.00		1.00	
笹岡　かおる（非構造物対策/業務調整）	6	計画	(30) (15)		1.50		0.00		1.50	
		実績	10/22-11/20 (30) 1/23-2/27 (15+21)		2.20		0.00		2.20	
佐々木　央（非構造物対策/業務調整）	6	計画		(30) (15) (30)	0.00		2.50		2.50	
		実績		8/22-9/10 (20) 1/12-1/26 (15) 2/28-4/8 (40)	0.00		2.50		2.50	
		計画			26.50		28.93		56.93	
		実績			30.06		28.50		60.76	

凡例

計画	（灰色）	自社負担	（橙色）
実績	（黒色）	追加契約	（赤色）
他業務による渡航	（青色）		

要員計画

2．国内業務

氏名 （担当業務）	格付		2014年度								2015年度												2016年度												2017年度												2018年度						人／月					
			8	第1期																			第2期																														第1期		第2期		計	
				9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	現地	国内	現地	国内	現地	国内
原　龍一 （総括/土砂災害解析）	2	計画		(3)							(3)	(7)																																					(2)						0.65		0.10		0.75
		実績		9/24-26 (3)							4/1,1,14,17 (3)	5/20-22,25-28 (7)																																									8/1,2 (2)						0.65		0.10		0.75
大河原　彰 （地すべり対策(設計・施工監理)）	3	計画		(1)							(2)	(3)																																					(2)						0.30		0.10		0.40
		実施		9/24 (3)							4/1,14 (2)	5/25-27 (3)																																									(4)						0.30		0.20		0.50
川上　京一 （斜面崩壊対策(設計・施工監理)）	3	計画		(1)							(3)	(7)																																					(1)						0.55		0.05		0.60
		実施		9/27 (1)							4/14,15,22 (3)	5/20-22,25-28 (7)																																									(1)						0.55		0.05		0.60
荻野　隆 （落石対策(設計・施工監理)）	5	計画																																																		0.50		0.00		0.50
		実施									4/6-10,13-17 (10)																																														0.50		0.00		0.50
鵜澤　幸二 （調達/入札評価）	5	計画													(5)																																							0.25		0.00		0.25
		実施													8/17-21 (5)																																							0.25		0.00		0.25
小池　徹 （地すべり対策(リスク評価)）	5	計画																																																		0.00		0.00		0.00
		実施																																																		0.00		0.10		0.10
笹岡　かおる （国内研修管理）	6	計画									(10)																																											0.50		0.00		0.50
		実施									4/6-10,13-17 (10)																																														0.50		0.00		0.50
佐々木　央 （国内研修管理）	6	計画																																																		0.00		0.50		0.50
		実施																																																		0.00		0.50		0.50
		計画																																																		2.75		0.75		3.50
		実績																																																		2.75		0.95		3.70
報告書等				W/P △													C/P △										△ PR1										△ PR2														FRJ,FRE △		30.06	2.75	28.50	0.95	60.76	3.70
																																																						32.81		29.45		64.46	

凡例　　計画　自社負担　他業務による渡航
実績　追加契約

添付資料　5

研修員受入実績

スリランカ国土砂災害対策強化プロジェクト

【有償勘定技術支援】（第 1 期）

土砂災害対策技術

研修員受入業務完了報告書

2015 年 5 月 7 日

株式会社地球システム科学

日本工営株式会社

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１．報告内容

（１） コース概要

(a) コースの名称（和文／英文）

和文： 土砂災害対策技術
英文： Technology against Landslide

(b) 研修期間

平成 27 年 4 月 18 日（来日）から同年 4 月 28 日（離日）まで

(c) 研修員人数

5 名（氏名、所属については、「２．添付資料（b）研修員リスト」に示すとおりである。）

（２） 研修内容

(a) 研修全体概念図

本研修は「スリランカ国土砂災害対策強化プロジェクト【有償勘定技術支援】(第 1 期)」の一環として実施された。本プロジェクトでは中部州キャンディ県、マタレ県、ヌワラエリア県及びウバ州バドゥッラ県のパイロット地区において、

① 砂災害対策のための調査・評価、
② 地すべり対策、斜面崩壊対策及び落石対策のための設計、施工監理及びモニタリング
③ 非構造物対策を含む土砂災害軽減対策

の知識とノウハウを蓄積することにより、NBRO の土砂災害管理能力の向上を図り、もって対象地域の土砂災害の減少に寄与することを目的としている。

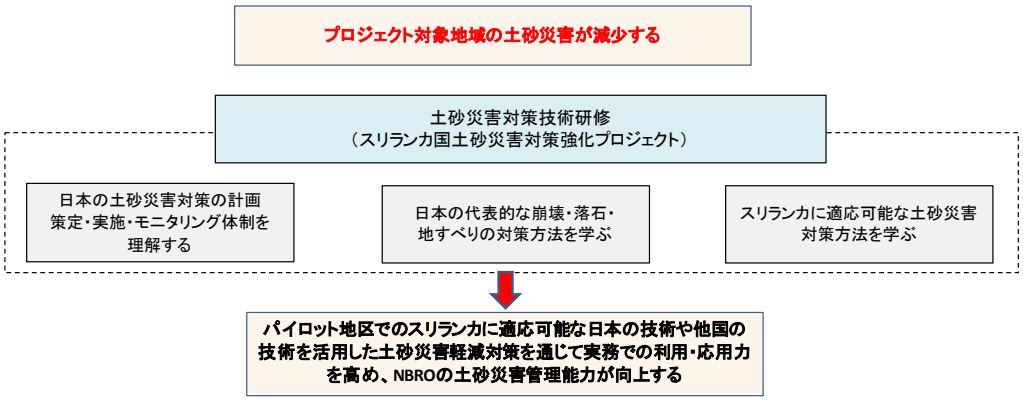
その中で今回実施した本邦研修は NBRO 本部およびキャンディ県、マタレ県、から実務担当者が参加し、経験工学的なアプローチで計画の策定・実施・モニタリングが行われており、豊富な経験を持つ我が国で直接体感することにより、プロジェクトの活動の理解の促進を図り、スリランカ国においての設計・施工監理および、モニタリング能力を強化することである。研修目標としては以下の 3 項目を設定した。

① 日本の土砂災害対策の計画策定・実施・モニタリング体制を理解する

② 日本の代表的な崩壊・落石・地すべりの対策方法を学ぶ

③ スリランカに適応可能な土砂災害対策方法を学ぶ

本研修の位置付け等の全体概念は図－１に示すとおりである。



図－１本研修の全体概念図

(b) 日程表

研修の実施日程は、「２．添付資料（a）研修詳細計画表（実績版）」に示すとおりである。

(c) 研修カリキュラム

カリキュラム概要を表－１に示す。

表－１　カリュキュラム概要

日付	曜日	時間	研修内容	講師または見学先担当者等
4 月 18 日	土		来日	
4 月 19 日	日		休日	
4 月 20 日	月	10:00-12:30	JICA ブリーフィング	JICA 東京国際センター研修監理員 松本　純子
		14:00-14:20	国土交通省砂防部長表敬訪問	国土交通省水管理・国土保全局　大野宏之部長
		14:45-16:45	日本における土砂災害対策の概要／土砂災害対策各機関の役割と連携	国土交通省水管理・国土保全砂防部砂防計画課地震・火山砂防室　岡本敦室長
4 月 21 日	火	11:00-12:00	がけ崩れと災害対策	国土交通省国土技術総合研究所土砂

日付	曜日	時間	研修内容	講師または見学先担当者等
				災害研究室　松下　一樹主任研究官
		13:00-15:00	地すべりのメカニズムと調査・観測	(独)土木研究所土砂管理研究グループ藤平　大
		15:15-16:45	土砂災害警戒避難基準雨量の設定と活用	国土交通省国土技術総合研究所土砂災害研究室　國友　優室長
4 月 22 日	水	9:30-12:00	地すべり対策の設計・施工	(一財)砂防・地すべり技術センター斜面保全部　相楽　渉技術課長代理
		13:30-15:30	がけ崩れ、落石などの対策の設計・施工	(一財)砂防・地すべり技術センター　萬徳　昌昭企画部長
4 月 23 日	木	9:00-12:00	静岡県由比地区地すべり対策事業視察	国土交通省中部地方整備局富士砂防事務所
		14:00-17:00	静岡県内の地すべり対策事業視察	静岡県交通基盤部河川砂防局砂防課
4 月 24 日	金	13:00-16:30	神奈川県急傾斜地崩壊対策・地すべり対策事業視察	神奈川県県土整備局河川下水道部砂防海岸課
4 月 25 日	土		アクションプラン作成／資料整理	
4 月 26 日	日		アクションプラン作成／資料整理	
4 月 27 日	月	9:00-12:00	アクションプラン作成	(株)地球システム科学　笹岡　かおる
		13:00-15:00	アクションプラン発表会	(株)地球システム科学　笹岡　かおる
		15:20-16:30	評価会、閉講式	JICA 東京国際センター 経済基盤開発・環境課高垣　隆博 人間開発・経済基盤開発・環境担当次長　上島　篤志
4 月 28 日	火		帰国	

（３）　研修コースに対する所見

(a)　　講義

本研修では現場視察の前に座学研修を組む形とした。講義ではまず初めに国土交通省を訪問し、日本における土砂災害対策の概要および日本での土砂災害対策各機関の役割について講義を受け、日本における土砂災害の歴史や、土砂災害の種類、国レベルでの対策と地方行政レベルでの対策、土砂災害関連法案の成り立ち等について学んだ。スリランカでは土砂災害は地すべりの一種類のみの分類となっているが、日本では土石流、地すべり、がけ崩れの三種類に分類され、研修員にとって非常に興味深かったようである。2 日目、3 日目は初日の国土交通省での講義を受けて、さらに踏みこんだ各種土砂災害のメカニズムや対策工の種類・設計、警戒避難基準雨量の設定方法等について学んだ。講義ではプレゼンテーションだけでなく、積極的にビデオや写真を紹介していただき、研修員の理解促進に大変有益であった。日本では国の役割と地方行政の役割が明確に定まっていることを学び、役割区分等、研修員には非常に参考になったようである。また、現在スリランカでは単純な日雨量・時間雨量に基づいて警戒情報を発出しているが、日本ではタンクモデルを利用した警戒避難基準雨量の設定を行っていることを学び、研修員からは是非スリラン

カでも採用したいとの意見が聞かれた。全体を通して積極的な質問がなされ、非常に強い学ぶ姿勢が認められた。

(b)　討論・実習・演習・発表

アクションプランの作成・発表については、5名で1グループとし、スリランカでの現状・課題の整理、本研修を通して学んだこと、本研修での習得事項を今後どのように活かしていくか、という点に焦点を置いて作成を行った。アクションプランの作成要項は研修の初日に配布し、説明を行った。研修中から研修員の中でアクションプラン作成に係る話し合いを行っていたようであり、大変具体的なアクションプランとなった。

アクションプランの発表においては2時間の時間を取り、1時間をアクションプランの発表に、その後の1時間を質疑応答および研修員と専門家との意見交換の時間に充てた。質疑応答の時間を長く取ることにより、研修を踏まえたうえで十分に研修員と専門家で意見交換を行う事が出来た。

スリランカでの土砂災害対策の課題としては、以下の項目が挙げられた。

- 傾斜地への居住
- 貧困
- 地域住民から十分な協力が得られない・住民の啓発レベルが不十分
- 地域レベルでの早期予警報システムの欠如・早期予警報システムを確立するためのデータの不足
- 開発事業実施時における地すべりハザードマップや災害軽減対策の軽視
- 地すべり対策事業予算確保のための系統だったシステムの欠如
- 財政、人材の不足及び能力不足
- 特に個人世帯における土地承認制度における適切なシステムの不足

以下に研修員が本研修で習得した知見をもとに作成したアクションプランを示す。

表―２　アクションプラン

	Objective	Actions	Responsible Persons	Target Dates
1	Identification of the gaps in the present database, strengthening and updating to build it up comprehensively and continue collection of data for future improvements of the present landslide disaster risk reduction measures.	1. Establish a technical team to perform this task 2. Review the present landslide database 3. Discuss and draft the format for the planed database	NBRO scientists	December 01, 2015
		4. Hold a workshop and present the draft format to other relevant parties finalize the format	NBRO scientists, Divisional Secretaries, Local Authority officials, and JICA experts	December 15, 2015
		5. Continue collecting data based on the finalized format	NBRO scientists, Grama Niladhari,	January 01, 2016
2	Re-evaluation of the rainfall threshold values based on the local conditions and scientific models used by other countries and using the resulting thresholds for issuance of local level early warning.	1. Collect current and 15 day cumulative rainfall data associated with landslides through rain gauges maintained by NBRO, Met Department, Plantation sector and Irrigation Department	NBRO scientists, Irrigation Department officials, Plantations and Met Department, Survey Department officials	May 01, 2025
		2. Study the existing models used for evaluation of threshold values and predicting landslides	NBRO scientists, JICA	December 31, 2015
		3. Finalizing a landslide prediction model suitable for issuance of predicting local level landslides	NBRO scientists, JICA	December 25, 2025
		4. Develop NBRO's capacity to develop local level landslide forecasting model and rainfall thresholds	Directors, Director General, JICA, and other technical and financial support agencies	
3	Developing the present national early warning system further into issuance of local level site specific early warning.	1. Debriefing the importance of issuance of local level early warning to the NBRO management	JICA Trained NBRO scientists, Directors, Director General	May 06, 2015
		2. Discussing the matter with the Government	Director General, Secretaries to the Ministry of Disaster Management, Ministry of Public Administration, and Ministry of Local Government	July 06, 2015
		3. Gaps in the line of communication to be identified	- Do -	June 30, 2015
		4. Formulation of the policy for issuance of local level early warning	- Do -	October 31, 2015
		5. Implementation of the policy and issuance of local level early warning	- Do -	November 31, 2015
4	Once a landslide or a potential area is identified, development of a master plan to mitigate it following the steps of applying control measures and restraint	1. Preliminary investigation of landslide or the potential area	NBRO scientists	01 week after occurrence or identification of landslide
		2. Determine the elements at risk and severity of the landslide	NBRO scientists	

	Objective	Actions		Responsible Persons	Target Dates
	work.	3.	Decide on the control measures and the restraint measures to be taken and the urgency of implementing the measures	NBRO scientists, Divisional and District Secretaries, DMC	02 weeks after preliminary investigation
		4.	Prepare the master plan for reducing the landslide disaster risk	NBRO scientists	03 weeks after preliminary investigation
		5.	Present the master plan to the Management for evaluation and funding	Senior Scientists, Directors, Director General	
		6.	Receiving the approval for the master plan, proceeding with detailed investigation and monitoring of the landslide	NBRO scientists,	01 week after presenting the master plan to the management
		7.	Receiving the approval and proceeding with designing of control measures and restraint measures	NBRO scientists,	Will be decided based on case to case basis
		8.	Implementation of mitigation measures	Directors, Director General	
		9.	Procurement and construction		
		10.	Develop NBRO's capacity further to implement investigating, monitoring, designing and implementing of mitigation measures	Directors, Director General, JICA, and other technical and financial support agencies	
5	Develop a system and acts that impose implementation of prepared master plans through appropriate implementing agencies.	1.	Based on the severity of the landslide and the socio economic importance of the location, draft a system for deciding on funding procedures and identification of implementing agencies	JICA Trained NBRO scientists	December 31, 2015
		2.	Discuss the draft system with relevant parties	NBRO scientists, Management, Ministry of Disaster Management and other relevant parties	January 15, 2016
		3.	Update and finalize the system and develop necessary policy and acts	NBRO scientists, Management, Ministry of Disaster Management and other relevant parties	December 31, 2016
		4.	Obtaining necessary approvals	NBRO scientists, Management, Ministry of Disaster Management and other relevant parties	March 31, 2015
		5.	Implement the developed policies and acts	NBRO scientists, Management, Ministry of Disaster Management and other relevant parties	May 01, 2016
6.	Develop the capacity of NBRO with necessary	Included under the actions of the objectives No. 2 and No. 4			

	Objective	Actions	Responsible Persons	Target Dates
	resources to carry out investigations, monitoring, design, and implementation of mitigation measures.			
7	Develop systematic guidelines and data collection formats enabling relevant agencies to evaluate the landslide disaster risk associated with life and properties within their jurisdiction.	To be implemented along with the actions of objective No. 1		

(c)　見学

見学箇所を、表－３に示す。

表－３　見学箇所一覧

所管	箇所名	概要
国土交通省　中部地方整備局 富士砂防事務所	由比地すべり対策事業	直轄地すべり対策事業による深礎杭工や排水トンネル、集水井等の大規模な対策工事
静岡県交通基盤部河川砂防局 砂防課	「ウスイ坂南」 地すべり防止区域	横ボーリング工や水路工等の抑制工による小規模な地すべり対策工事
	「丸子逆川」 地すべり防止区域	アンカー工やロックボルト工等の抑止工による地すべり対策工事
	静岡県地震防災センター	静岡県の地震被害の予測や対策に関する講義、及び耐震コーナー等のセンター内施設の見学
神奈川県県土整備部河川下水道部砂防海岸課	「大滝町地区」 急傾斜地崩壊危険区域	フリーフレーム工による急傾斜地崩壊対策工事
	「田浦町 D 地区」 急傾斜地崩壊危険区域	コンクリート張工による急傾斜地崩壊対策工事
	「大沢地区」 地すべり防止区域	鋼管杭工による地すべり対策工事
	「城ケ島地区」 急傾斜地崩壊危険区域	コンクリート張工による急傾斜地崩壊対策工事を利用した、津波避難階段

講義により得た情報を基に各地区の見学を行ったことから、講義の内容を実際に見ることによってより理解が深まり、適切な講義・見学の構成であった。

また、国土交通省の直轄事業による先進的な深礎杭や排水トンネル等の大規模な対策工事や、県レベルでの鋼管杭工やアンカー工による抑止工の視察を行った。また、同じく県レベルでの将来的にスリランカでも適用できる可能性のある、コンクリート張工等の中規模な工事、及び現時点でもスリランカで適用可能な横ボーリング工や水路工等の小規模な対策工事まで、各種対策工を見学できたことは非常に有益であった。さらに、スリランカでは 2004 年に津波による甚大な被害があったため、急傾斜地崩壊危険区域における対策工を利用した津波避難階段の視察までを行えたことは、非常に有益であった。

全体を通して視察時に行程が遅れるほど熱心に質問が出され、視察を行った対策工事から、スリランカに適用可能な対策工や将来的に適用したい対策工等についてのアイディアを得ることができたことは、非常に有益であった。

(d)　研修期間、配列、内容

今回は研修員がスリランカで多忙という事もあり、実質の研修期間は 6 日間となり、タイトな研修となったことは否めないが、研修員からは概ね研修期間は適切であったとの意見があった。研修の配列としては、前半に座学を組み、日本における土砂災害対策のシステムや各対策工について学んだあと、研修の後半に実際の対策工の現場視察を行った。現場視察前に座学を組み込んだことで現場視察時の理解が深まり、大変有効であった。次回の本邦研修ではジュニア研究員が対象となる予定であるため、その場合は各講義や視察において今回よりも時間をかけて説明することが必要であり、期間は 2 週間ほどあった方が良いとの意見が聞かれたため、次回本邦研修計画時の検討事項とする。

(e)　テキスト、機材、施設

テキストは事前に各研修受け入れ機関から受領し、研修員の予習のために研修初日に配布した。研修員は各研修の前に熱心にテキストに目を通しており、理解促進につながった。テキストで一部字が小さく読みにくい部分があり、今後印刷の際は余白を狭くするなどの配慮が必要である。今回の研修では各研修受入れ機関に赴く形を取ったが、研修員の中には JICA 東京国際センターの外で講義が行われる場合は常にバスを利用したいとの意見があった。移動時には特段問題は起こらなかったが、東京近郊の電車は複雑であり、電車での移動に慣れていない研修員にとっては負担であったようである。

（4） 研修員

(a)　資格要件

今回参加した 5 名の研修員は実務者レベルの主任研究員であり、本研修を受けるのには最適であったと考えられる。主任研究員が本研修において知識を得たとこにより NBRO 全体能力強化につながることはもとより、帰国後に本プロジェクトでの成果をジュニア研究員に伝えることにより、研修の波及効果が期待できる。また、次回本邦研修の対象者であるジュニア技術者にとっては予備知識を身につける良い機会であると考える。

語学についても研修員はスリランカでも常に英語を使用しており、英語による本

研修には全く支障はなかった。

(b)　研修参加への意欲、受講態度

研修員は各講義において活発に質問をしており、研修参加への意欲、受講態度ともにとても高かったと言える。前述のとおり、講義の前にはテキストに目を通しており、講義の後にも研修員の中で復習をしていたようである。

（５）　研修成果の活用

(a)　研修で得られた成果について

アンケート結果では、研修目標として設定した 3 項目のいずれにおいても達成度が高く、本研修で得られた成果は今後の業務において活用可能であると回答している。スリランカでは十年前では考えられなかった対策工が近年では施工可能となってきており、今後急速に対策工技術の発展が予想される。そうした状況の中で今回日本における対策工の計画策定やモニタリングシステム、代表的な対策工について学んだことは大変有用である。

(b)　成果の活用方法について

本研修を通じて日本の土砂災害対策に係るシステムや機関、実際の対策工を見たことにより、今後カウンターパートと専門家の意思疎通が現在以上に円滑になり、プロジェクトを進める上で非常に有益である。

（６）　研修環境

研修員は電車での移動に不便さを感じることもあったようである。JICA 東京国際センターにおける滞在の中では食事もバラエティ豊かであり、ベジタリアンの研修員も何ら不便はなかったようである。インターネット環境について、WIFI を利用できれば更に良かったとの意見があった。

（７）　その他特記事項

本研修は一部の日程（4 月 20 日午後、4 月 21 日終日、4 月 23 日終日）でアルメニア本邦研修「地すべり災害管理能力の向上」と合同で研修が実施された。合同研修

中はパナガイドを用いてスリランカ側は日本語から英語へ、アルメニア側は日本語からロシア語へ通訳することで対応したが、特に混乱はみられなかった。研修生からはアルメニアの土砂災害の情報について情報交換や意見交換をする良い機会になったとの意見が聞かれた。しかし講義の際にプロジェクターに映すスライドは英語であったため、アルメニア側は不便を感じていた可能性がある。合同で研修を実施する際は各国の使用言語も考慮することが望ましいと考えられる。

２．　添付資料

（a）　研修詳細計画表（実績版）

（b）　研修員リスト

（c）　研修員との意見交換結果など、研修員個々の評価

（ｄ）　著作物の利用条件一覧

２．添付資料

(a)　研修詳細計画表（実績版）

研修コース名： 土砂災害対策技術（和名） Technology against Landslide（英名）　　2015年4月28日

研修コース番号：　　受入形態　国別研修

研修期間： 4月19日（来日） ～ 4月28日（離日）　　研修員数　5

研修目標： 豊富な経験を持つ我が国で直接体感することにより、プロジェクトの活動の理解の促進を図り、スリランカ国においての設計・施工監理および、モニタリング能力を強化する

研修項目：
①日本の土砂災害対策の計画策定・実施・モニタリング体制を理解する
②日本の代表的な崩壊・落石・地すべりの対策方法を学ぶ
③スリランカに適応可能な土砂災害対策方法を学ぶ

日付	時刻	形態	研修内容	講師又は見学先担当者等		講師使用言語	受注者同行者	研修場所	宿泊先
				氏名	所属				
4/19(日)	～		来日						JICA東京国際センター
4/20(月)	10:00 ～ 12:30	講義	JICAブリーフィング	松本　純子	JICA東京国際センター研修監理員	英語		JICA東京国際センター（幡ヶ谷）セミナールーム302	JICA東京国際センター
	14:00 ～ 14:20	講義	国土交通省砂防部長表敬訪問	田胡　匡基	国土交通省水管理・国土保全局砂防部砂防計画課地震・火山砂防室(tel: 03-5253-8468)	英語	2	国土交通省水管理・国土保全局砂防部（霞が関）合同庁舎3号館2F南　砂防部	
	14:45 ～ 17:00	講義	日本における土砂災害対策の概要／土砂災害対策各機関の役割と連携	岡本敦	国土交通省水管理・国土保全局砂防部砂防計画課地震・火山砂防室	日本語	2		
4/21(火)	9:00 ～ 11:00		移動（東京→つくば市）						JICA東京国際センター
	11:00 ～ 12:00	講義	がけ崩れ災害と対策	松下一樹	国総研土砂災害研究室主任研究官（tel:029-864-2213)	日本語	1	（独）土木研究所・国土技術政策総合研究所（つくば）国総研旭庁舎201会議室	
	13:00 ～ 15:00	講義	地滑りのメカニズムと調査・観測	藤平大	土砂管理研究G地すべり主任研究員(tel:029-879-7687)	日本語	1		
	15:15 ～ 16:45	講義	土砂災害警戒避難基準雨量の設定と活用	國友優	国総研土砂災害研究室室長	日本語	1		
	17:00 ～ 19:00		移動（つくば市→東京）						
4/22(水)	9:30 ～ 12:00	講義	地すべり対策の設計・施工	相楽渉	（一財）砂防・地すべり技術センター斜面保全部技術課長代理	日本語	2	（一財）砂防・地すべり技術センター（市ヶ谷）6F大会議室	静岡市内
	13:30 ～ 15:30	講義	がけ崩れ、落石などの対策の設計・施工	萬徳昌昭	（一財）砂防・地すべり技術センター企画部長(tel:03-5276-3271)	日本語	2		
	15:30 ～ 17:30		移動（東京→静岡）						
4/23(木)	9:00 ～ 12:00	見学	静岡県由比地区地すべり対策事業	川島由比出張所長（当日tel:090-7315-7741）	国土交通省中部地方整備局　富士砂防事務所（担当：黒田課長tel:0544-27-5387)	日本語	1	静岡県由比地区(さった峠展望台待ち合わせ)	静岡市内
	14:00 ～ 17:00	見学	静岡県内の地すべり対策事業／静岡県内小規模地すべり対策視察	井上泰孝主査（当日tel：090-8679-6831）	静岡県交通基盤部河川砂防局砂防課(tel: 054-221-3043)	日本語	1	静岡県ウスイ坂南、丸子逆川、地震防災センター	
4/24(金)	9:00 ～ 11:30		移動（静岡→横須賀）						JICA東京国際センター
	13:00 ～ 16:30	見学	神奈川県急傾斜地崩壊対策事業・地すべり対策事業視察	万木ゆるぎ（当日tel：080-5912-7485）	神奈川県県土整備局河川下水道部砂防海岸課　(tel: 045-210-6508) 「大滝町」：急傾斜地第二課　長谷川準三　技師 「田浦町Ｄ」：急傾斜地第一課　三浦剛　主任技師 「大沢」　：河川砂防課　宮田敏郎 主任技師 「城ヶ島」：急傾斜地第二課　池田雅己　課長	日本語	1	神奈川県大滝町、田浦町、大沢、城ヶ島	
	16:30 ～ 19:00		移動（三崎口→東京）						
4/25(土)	～		アクションプラン作成／資料整理						JICA東京国際センター
4/26(日)	～		アクションプラン作成／資料整理						JICA東京国際センター
4/27(月)	9:00 ～ 12:00	実習	アクションプラン作成	笹岡かおる	（株）地球システム科学		2	JICA東京国際センター（幡ヶ谷）セミナールーム406	JICA東京国際センター
	13:00 ～ 15:00	発表	アクションプラン発表会			英語	2		
	15:20 ～ 17:30		評価会、閉講式	高垣　陸博／上島　篤志	JICA東京国際センター経済基盤開発・環境課／人間開発・経済基盤開発・環境担当次長	英語	2		
4/28(火)	～		帰国						

(b)　研修員リスト

組織名	研修員名	役職
NBRO (National Building Research Organization), Ministry of Housing & Samurdhi	Mr. Halvithana Athukoralalage Gamini J.	Senior Scientist/Eng. Geologist, Landslide Research & Risk Management Division 主任研究員 / 地質技術者
	Ms. Weerasinghe Kumari Mala	Dy. Project Director & Senior Scientist, Landslide Research & Risk Management Division 副プロジェクトマネージャー / 主任研究員
	Mr. Udage Kankanange Nishrd Pasantha D.	Senior Scientist/ Sinior Engineer, Landslide Research & Risk management Division 主任研究員 / 主任技術者
	Mr. Peiris Nishantha Indrajith Camillus	Senior Scientist/ Office in Charge of Kandy District, Landslide Research & Risk Management Division 主任技術者 / キャンディ事務所長
	Mr. Moremada Mudiyanselage Chaminda U. B. M.	Geologist/ District Officer-Matale, Landslide Research & Risk Management Division 地質技術者 / マタレ事務所長

（c）　　研修員との意見交換結果など、研修員個々の評価

研修を通して研修員からは以下のような意見が聞かれた。

Mr. Halvithana Athukoralalage Gamini J.	現地視察が大変勉強になった。加えて早期予警報システムの形態についてももう少し学べると良かった。現在スリランカで行われている対策工は適切な計画が必要であり、今回の研修では計画について学ぶことができ大変有用であった。本研修で学んだ対策工はスリランカでも今後活用していきたい。研修の一部はアルメニアからの研修員と合同で実施されたが、アルメニアの現状等について情報交換をする良い機会となった。
Ms. Weerasinghe Kumari Mala	日本は災害大国であるが、災害を乗越え、今日に至っており、堅固なシステムを構築している。日本では構造物対策と非構造物対策の両方が同等に行われているが、スリランカでは予算面での課題もあり、非構造物対策となっている箇所もある。研修を通してスリランカの現状に対する課題を見つけることができたため、今後は本研修を通じて習得した知見を活かして課題を克服していきたい。対策工の設計について、机上エクササイズができればなおよかった。
Mr. Udage Kankanange Nishrd Pasantha D.	スリランカと日本の対策工の違いについて学ぶことができ大変有益であった。スリランカではソイルネイリングが使われているが、同様の効果が期待できる対策工としてケーブールアンカーを使用した対策工を学び、スリランカでも是非実施してみたい。 特に荷物があるときは電車での移動が大変であり、基本的にバス移動であるとなお良いと思った。
Mr. Peiris Nishantha Indrajith Camillus	現場視察で多くの事を学んだ。本研修で学んだ対策工はスリランカでも施工可能と考えており、是非活用したい。現場視察は 2 日間のみとなっており、最低 5 日間は必要であると感じた。
Mr. Moremada Mudiyanselage Chaminda U. B. M	研修と通しては現場視察が有益であった。コミュニティでの活動についてもう少し学べると良かった。研修環境も非常によく、宿舎で WIFI を使えるとなお良いと感じた。研修で学んだ知見を今後業務の中で活用していきたい。

（ｄ） 著作物の利用条件一覧

コース名：土砂災害対策							
No.	**テキスト名**	**講義名**	**講師名**	**所属**	**使用日**	**利用許諾内容**	**備考**
1	Outlines of Measures for Sediment Disaster Prevention in Japan (Roles of Responsible Organizations and Their Coordination)	日本における土砂災害対策の概要／土砂災害対策各機関の役割と連携	岡本　敦	国土交通省水管理・国土保全局砂防部	2015年4月20日	(1)-a), b), c), d) (2)-a),b),c),d) (3)-a),b)	
2	Slope Failure Disasters and Countermeasures	がけ崩れ災害と対策	松本　一樹	国土技術政策総合研究所	2015年4月21日	(1)-b), c), d) (2)-利用不可 (3)-利用不可	
3	Outline of Sediment Disaster Early Warning in Japan	土砂災害警戒避難基準雨量設定と活用	國友　優	国土技術政策総合研究所	2015年4月21日	(1)-a), b), c), d) (2)-利用不可 (3)-利用不可	
4	Mechanism, Investigation and Observation of Landslide	地すべりのメカニズムと調査・観測	藤平　大	（国立研究開発法人）土木研究所	2015年4月21日	(1)-利用不可 (2)-利用不可 (3)-利用不可	
5	Structural Countermeasures for Landslide	地すべり対策の設計・施工	相楽　渉	一般財団法人砂防・地すべり技術研究センター	2015年4月22日	(1)-b), c) (2)-b) (3)-a)	
6	Measures against Landslides and Rock Falls	がけ崩れ、落石などの対策の設計・施工	萬徳　昌昭	一般財団法人砂防・地すべり技術研究センター	2015年4月22日	(1)-a), b), c) (2)-a),b),c) (3)-a)	
7	Outline of Yui Landslide Countermeasure Project	静岡県由比地区地すべり対策事業視察	黒田　英伸（調整窓口）	国土交通省中部地方整備局富士砂防事務所	2015年4月23日	(1)-a), b), c), d) (2)-a), b), c), d) (3)-a), b)	「出典：富士砂防事務所資料」と明記する事
8	Land Prevention	静岡県内地すべり対策	井上　泰孝（調整窓	静岡県交通基盤部	2015年4月23日	(1)-a), b), c), d)	

コース名：土砂災害対策							
No.	テキスト名	**講義名**	**講師名**	**所属**	**使用日**	**利用許諾内容**	**備考**
	Work Mater Plan for Usuizaka Minami and Maruko Sakasagawa	事業／小規模地すべり対策視察	口）	河川砂防局砂防課		(2)-a), b), c), d) (3)-a), b)	
9	Outlines of Countermeasure Project in Jogashima, Otaki, Osawa and Taura	神奈川県急傾斜地崩壊対策事業・地すべり対策事業視察	間ヶ部　健夫（調整窓口）	静岡県県土整備局河川下水道部砂防海岸課	2015 年 4 月 24 日	(1)-a), b), c), d) (2)-利用不可 (3)-利用不可	日本語資料、翻訳資料に個人の名前が記載されている場合（残っている場合）はマスキングの上、利用の事。事業費・契約金額を空欄にした資料のみ(2),(3)においても利用を許諾する。

スリランカ国
土砂災害対策強化プロジェクト
【有償勘定技術支援】（第 2 期）

土砂災害対策技術

研修員受入業務完了報告書

2017 年 6 月

株式会社地球システム科学

日本工営株式会社

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１　報告内容

（１）　コース概要

（a）　コースの名称

和文：土砂災害対策技術

英文：Land Slide Mitigation

（b）　研修期間

2017 年 5 月 14 日（来日）から 5 月 27 日（離日）まで

（c）　研修員人数

国家建築研究所職員 5 名

詳細は「添付資料（b）研修員リスト」に示すとおりである。

（２）　研修内容

（a）　研修全体概念図

本研修は「スリランカ国土砂災害対策強化プロジェクト【有償勘定技術支援】（第 2 期）」の一環として実施された。本プロジェクトでは中部州キャンディ県、マタレ県、ヌワラエリア県及びウバ州バドゥッラ県のパイロット地区において、以下の事業を実施している。

① 砂災害対策のための調査・評価
② 地すべり対策、斜面崩壊対策及び落石対策のための設計、施工監理及びモニタリング
③ 非構造物対策を含む土砂災害軽減対策

これらの知識とノウハウを蓄積することにより、スリランカ国国家建築研究所（National Building Research Organisation、以下 NBRO）の土砂災害管理能力の向上を図り、もって対象地域の土砂災害の減少に寄与することを目的としている。

その中で今回実施した本邦研修は NBRO 本部およびゴール県、ラトナプラ県から実務担当者が参加した。スリランカでは経験工学的なアプローチで計画の策定・実施・モニタリングが行われているため、豊富な経験を有する我が国での調査や施工、法整備等について直接体感することにより、プロジェクトの活動の理解の促進を図る。研修目標としては以下の 3 項目を設定した。

① 日本の土砂災害対策の計画策定・実施・モニタリング体制を理解する
② 日本の代表的な崩壊・落石・地すべり・土石流の対策方法を学ぶ
③ スリランカに適応可能な土砂災害対策方法を学ぶ

本研修の位置づけ等の全体概念は図 1 に示すとおりである。

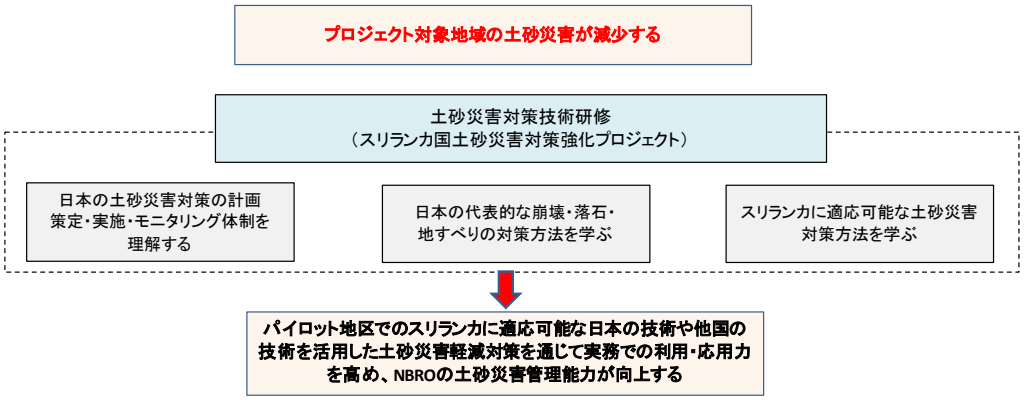


図 1　本研修の全体概念図

(b)　日程表

研修の実施日程は「添付資料（a）研修詳細計画表（実績版）」に示すとおりである。

(c)　研修カリキュラム

カリキュラム概要を表 1 に示す。

表 1　研修工程概要

日付	曜日	時間	研修内容	研修先
5 月 14 日	日		来日	
5 月 15 日	月	10:00～12:00	JICA 規定ブリーフィング	JICA 東京国際センター
		14:00～14:30	国土交通省砂防部表敬訪問	国土交通省 水管理・国土保全局砂防部
		15:00～16:30	日本における土砂災害対策の概要及び各機関の役割と連携	
5 月 16 日	火	07:30～10:00	移動（東京→つくば）	
		10:00～12:00	地すべりのメカニズムと調査・観測	国立研究開発法人 土木研究所
		13:15～15:00	落石災害の調査・対策	
		16:00～17:30	土質試験所見学	日本工営株式会社
5 月 17 日	水	09:00～11:00	土石流の観測・対策	国土交通省 国土技術総合研究所
		11:00～12:00	がけ崩れ災害と対策	
		13:00～14:30	土砂災害警戒避難基準雨量の設定と活用	
		14:30～16:30	移動（つくば→東京）	
		16:30～17:30	地すべり対策の設計・施工	（一財）砂防・地すべり技術センター
5 月 18 日	木	9:00～12:00	移動（東京→静岡）	
		13:00～17:30	静岡県内の地すべり対策事業	静岡県交通基盤部河川砂防局

日付	曜日	時間	研修内容	研修先
			視察	砂防課
5月19日	金	9:00～12:30	静岡県由比地区地すべり対策事業視察	国土交通省中部地方整備局富士砂防事務所
		14:00～16:30	移動（静岡→東京）	
5月20日	土	終日	アクションプラン作成・資料整理	
5月21日	日	終日	アクションプラン作成・資料整理	
5月22日	月	9:00～11:30	移動（東京→神奈川）	
		13:00～17:30	神奈川県内急傾斜地崩壊対策・地すべり対策事業視察	神奈川県県土整備局河川下水道部砂防海岸課
5月23日	火	8:30～12:00	神奈川県内の土石流対策事業視察	
		13:30～16:00	移動（神奈川→東京）	
		16:00～16:30	赤木正雄像見学	一般社団法人 全国治水砂防協会
5月24日	水	10:00～16:30	総合防災体験	東京臨海広域防災公園
5月25日	木	10:00～11:00	予報業務の紹介	気象庁
		11:00～11:30	予報現業見学	
		11:40～12:20	観測現業見学	
		14:00～17:00	アクションプラン作成	JICA 東京国際センター
5月26日	金	09:00～12:00	アクションプラン作成	JICA 東京国際センター
		13:00～15:00	アクションプラン発表会	JICA 東京国際センター
		15:20～17:30	評価会、閉講式	JICA 東京国際センター
5月27日	土		帰国	

（3） 研修コースに対する所見

(a) 講義

本研修では講義形式の座学と実際の土砂災害対策事業の見学を実施し、理解の促進に努めた。

講義では国土交通省から日本全体の土砂災害対策事業概要の説明を受け、日本における土砂災害の分類、国レベル・地方レベルでの対応の違い、また土砂災害対策関連の法規制等について学んだ。スリランカでは土砂災害対策を主目的とした土地利用規制や対策の根拠法等がないため、非常に興味を持っていた。また、国土総合技術研究所及び気象庁からの説明にあった日本における土砂災害危険地の設定（イエローゾーン、レッドゾーン）や土砂災害警報発出基準については、設定根拠や計算方法等についてより踏み込んだ内容の質問を行っていたため、講義時間や協議、意見交換の時間がやや不十分であったと感じた。

全体を通して積極的に質問や協議がなされ、専門的な内容やスリランカとの違いについて、研修生自身も記録を取るとともに、研修生内部でも議論するなど熱心な姿勢が認められた。

(b)　討論・実習・演習・発表

アクションプランの作成については、5 名全員で 1 つのプレゼンテーションを作成し、スリランカでの現状と課題の整理、本研修を通して学んだこと、本研修での習得事項を今後どのように活かしていくか、という内容とした。

アクションプランの発表においては研修員からのプレゼンテーションに対して、本プロジェクトの長期専門家として従事していた判田乾一氏（国土交通省砂防部砂防計画課）からコメントをいただいた。判田氏が現地で説明していた日本との土地利用形態の違い（斜面の利用方法）を実際に現地視察で確認したことで、プロジェクトの運営や理解につながるものと考えられる。なお、スリランカでの土砂災害対策の課題としては、以下の項目が挙げられた。

- 土砂災害対策に関する法整備がなされていない
- 住民の防災意識啓発に関する組織が確立されていない
- 土砂災害ハザードマップの作成・評価手法に改善の余地がある
- 土砂災害危険地域に居住する住民の把握が十分ではない
- 災害記録は多く有しているが、決まった様式で整えられていない
- 土砂災害早期警報の評価、基準値設定を改善する必要がある

以下に研修員が本研修で習得した知見をもとに、短期・中期・長期のタイムラインを考慮したアクションプランを表 2 に示す。

表 2　アクションプラン

Objective	Short	Med	Long
Process Establishment			
Development of Standard Operation Procedures (SOP's) for Each activity	→		
Develop a working standard manuals for NBRO (Safety Control measures)	→		
Develop legal acts, amendments for hazard mitigation	→	→	→
Hazard Identification			
Integration of debris flow path for risk mapping	→		
Integration of tank model and soil water index for hazard warning	→	→	
Hazard Prediction and rainfall threshold calculation	→	→	
Instrumentation for hazard monitoring	→	→	
Mitigation Option			
Strengthen the testing procedures (In-site and laboratory)	→	→	
Introduce and practice of landslide community awareness mechanism	→		
Introduce and apply lightweight and precast mitigation techniques	→	→	→
Capacity improvements in Structural Mitigation	→	→	
Introduce the innovations for evacuation centers	→		
Develop guideline for identify safe lands for future settlements	→	→	
Evaluation Monitoring			
Monitoring and calibration of hazard monitoring instrument	→	→	
Evaluation of landslide mitigations activities, reporting and data storing	→	→	→

※Short：1～2 年程度　Mid：5 年程度　Long：10 年程度

(c)　見学

見学箇所一覧を表 2 に示す。

表 3　見学箇所一覧

管轄機関	箇所名	概要
日本工営株式会社	中央研究所	土質試験室の見学
静岡県交通基盤部河川砂防局砂防課	ウスイ坂南 地すべり防止区域	横ボーリング工や水路工等の抑制工による小規模な地すべり対策工事
	丸子逆川 地すべり防止区域	アンカー工やロックボルト工等の抑止工による地すべり対策工事
	セリガ谷沢 土石流防止区域	砂防堰堤の整備状況、地域住民との取り組み
国土交通省中部地方整備局富士砂防事務所	由比地区地すべり対策事業	直轄地すべり対策事業による深礎杭工や集水井、工事用仮設道路整備等の大規模な対策工事
神奈川県県土整備部河川下水道部砂防海岸課	小坪 2 丁目地区 急傾斜地崩壊危険区域	フリーフレーム工による急傾斜地崩壊対策工事
	田浦町 D 地区 急傾斜地崩壊危険区域	コンクリート張工による急傾斜地崩壊対策工事
	大沢地区 地すべり防止区域	鋼管杭工、横ボーリングによる地すべり対策工事
	城ヶ島地区 急傾斜地崩壊危険区域	コンクリート張工および津波避難施設の視察
東京都臨海広域防災公園	そなエリア	総合防災体験
国土交通省気象庁		予報現業見学および観測現業見学

講義で得た基本的な情報をもって各地域の見学を実施したことから、講義の内容を実際に確認でき、より理解が深まるとともに、全体的に適切な講義・見学の構成であったと考えられる。

日本における土砂災害の構造物対策は、斜面内の地下水位の低下を促す「抑制工」と物理的に土砂の移動を阻害する「抑止工」の 2 種類に大別される。いくつかの抑制工はスリランカで NBRO 主導の下で既に実施されているものもあるが、本邦における設計や計画のプロセス、適用範囲、工事に使用している部材の仕様等は異なるため、その点については各担当者に質問し確認していた。

また、抑止工はスリランカではほとんど実績を有していないため、国土交通省の直轄事業による大規模な深礎工や排水トンネル、県レベルでの小規模な鋼管杭工やアンカー工等の両方を視察し、工事規模や費用、工種選定、各工種による効果の評価手法等に興味を持

っていた。現在実施中の円借款事業「国道土砂災害対策事業」や中小企業支援事業「斜面防災技術（ユニット式金網型枠による吹付法枠工）の普及・実証事業」では、日本式の抑止工を含めた構造物対策が実施予定のため、スリランカでもそういった対策工が将来的に適用されることを期待する。

（d） 研修期間・配列・内容

前回の本邦研修（2015 年 5 月実施）の参加者のコメントから、実質的な研修期間を 10 日に設定し、前回よりも時間に余裕をもって研修内容及び配列を検討した。また、NBRO の新庁舎の建設及び土質試験室の移転が予定されているため、共同企業体の所有する研究所試験室視察も取り入れた。現地ではなかなか見る機会の少ない機材も多く所有していたため、使用方法や適用範囲、購入費用について多くの質問がなされていた。研修員からも全体を通して講義と現場見学のバランスは適切だったとの意見もあり、内容的にも概ね満足していたようである。

（e） テキスト・機材・施設

テキストは事前に各研修受け入れ機関から受領できたため、研修員の予習のために研修初日に配布した。研修員は各研修の開始前にテキストに目を通しており、理解促進につながったと考えられる。テキストの一部で用語の統一ができていなかった部分（講師自身による英訳を含め）もあったため、今後は可能な限り配慮が必要と考えられる。

今回の研修では各研修受入機関を訪問する形を取ったが、東京都以外の講義及び施設見学では貴機構の手配によるジャンボタクシーや新幹線の利用が可能であったため、特段の問題もなく運営することができたが、研修後半では東京近郊での電車移動にやや疲れを見せていた。

（4） 研修員

（a） 資格要件

今回参加した 5 名の研修員は実務者レベルの研究員から選定され、2017 年 1 月に実施した第 3 回短期専門家派遣時のワークショップや現地視察に参加した職員を 1~2 名程度含めることをプロジェクト側から要望した。研修生は概ね要望通りに選定されたため、研修内容について事前知識を持った職員が派遣され、研修生内でもお互いに補足しあうような形をとることができた。

語学についてはスリランカでは常に英語を準公用語として使用しているため、英語による本研修には支障はなかった。

（b） 研修参加への意欲・受講態度

研修員は各講義において活発に質問をしており、研修参加への意欲、受講態度ともに高かったと言える。前述のとおり、講義の前にはテキストに目を通しており、講義の後にも

研修員の中で復習をしていたようである。

本邦では土砂災害に限らず、調査手法や設計等に関するガイドラインや指針が整備されているが、スリランカではそのような基準づくりが進んでいない。そのため、ガイドライン等の英語版の提供を求めていたが、英語版の翻訳作業は基本的にプロジェクトベースで必要な部分だけ作成しているのが現状であるため、既存の翻訳済みのものだけ提供することとした。

（５） 研修成果の活用

（a） 研修で得られた成果について

スリランカでは経済発展や技術力の向上等により、徐々に対策工の実施能力が向上している。その一方で、それらの設計や調査、メンテナンス、維持管理に関する制度面での整備が立ち遅れているのが現状である。法制度の整備には長期的な対応が必要となるが、そういった取り組みの必要性を改めて認識したようである。また、土砂災害の種類（地すべり、がけ崩れ、土石流等）に応じた個別の危険度評価はスリランカでは行われていないため、それらの評価手法に興味を示していた。

（b） 成果の活用方法について

構造物によるハード対策は、資機材の調達や施工会社の技術的な経験・能力不足から直ちに現地で適用するのは困難である。よって、今回の研修で得られた成果のうち、特に早期警戒情報の向上や土地利用規制等のソフト対策の現地での適用を検討していきたいという意向を研修生は示していた。

（６） 研修環境

JICA 東京国際センターにおける滞在の中では食事については特に不便はなかったようであるが、外出先での食事については食事制限等によりファストフードになってしまうことが多かった。全体的に日本食はあまり口に合わなかったようである。

インターネット環境は移動の車内でも Wi-Fi 環境があり、研修生自身で海外ローミングしていたため、大きな問題は発生しなかった。

（７） その他特記事項

特になし。

2　添付資料

（a）　研修詳細計画表（実績版）等

研修詳細計画表（兼研修詳細計画表（実績版））

2017年6月1日

研修コース名：　スリランカ国　土砂災害技術

研修コース番号：　J1792011　　受入形態　国別研修

研修期間：　2017/5/14　～　2017/5/27　　研修員数　5 人

研修目標：日本の技術を活用した土砂災害軽減対策を学び、NBROの土砂災害管理能力が向上を図る

研修項目：①日本の土砂災害対策の計画策定・実施・モニタリング体制を理解する
②日本の代表的な崩壊・落石・地すべり・土石流の対策方法を学ぶ
③スリランカに適応可能な土砂災害対策方法を学ぶ

日付	時刻	形態	研修内容	講師又は見学先担当者等			講師使用言語	研修場所	宿泊先
				氏名	所属先及び職位	連絡先			
5/14(日)	～		来日						
5/15(月)	10:00 ～ 12:00		JICA規定ブリーフィング				英語	JICA東京国際センター SR301	JICA東京国際センター
	14:00 ～ 14:30	講義	国土交通省砂防部表敬訪問	西山　幸治	国土交通省　水管理・国土保全局砂防部長	03-5253-8111	日本語	国土交通省砂防部	
	15:00 ～ 16:30	講義	日本における土砂災害対策の概要及び各機関の役割と連携	熊澤　至朗	国土交通省 水管理・国土保全局砂防部砂防計画課　課長補佐	03-5253-8111	日本語	国土交通省砂防部	
5/16(火)	7:30 ～ 10:00		移動（東京→つくば）						JICA筑波センター
	10:00 ～ 12:00	講義	地すべりのメカニズムと調査・観測	竹下　航	土木研究所　土砂管理研究グループ地すべりチーム	029-879-6787	英語	土木研究所	
	13:15 ～ 15:00	講義	落石災害の調査と対策	浅井　健一	土木研究所　地質・地盤グループ	029-879-6751	日本語	土木研究所	
	15:00 ～ 16:00		移動（つくば→牛久）						
	16:00 ～ 17:30	見学	土質試験所見学	小林　浩二 新村　麻衣	日本工営(株) 総合技術開発部	029-871-2005	英語	日本工営(株)中央研究所	
5/17(水)	9:00 ～ 11:00	講義	土石流の観測・対策	松本　直樹	国土交通省国土技術総合研究所土砂災害研究部	029-864-4372	日本語	国土技術総合研究所	JICA東京国際センター
	11:00 ～ 12:00	講義	がけ崩れ災害と対策	村田　郁央	国土交通省国土技術総合研究所土砂災害研究部	029-864-2213	日本語	国土技術総合研究所	
	13:00 ～ 14:30	講義	土砂災害警戒避難基準雨量の設定と活用	野呂　智之	国土交通省国土技術総合研究所土砂災害研究部	029-864-2213	日本語	国土技術総合研究所	
	14:30 ～ 16:30		移動（つくば→東京）						
	16:30 ～ 17:30	講義	地すべり対策の設計・施工	相楽　渉	砂防・地すべり技術センター 斜面保全部技術課長代理	03-5276-3393	日本語	砂防・地すべり技術センター	
5/18(木)	9:00 ～ 12:00		移動（東京→静岡）						ホテルアソシア静岡
	13:00 ～ 17:30	見学	静岡県内の地すべり対策事業視察	杉山　一仁 油井　克之	静岡県交通基盤部 河川砂防局砂防課	054-221-3043	日本語	ウスイ坂南地区、丸子逆川地区、セリガ谷沢地区	
5/19(金)	9:00 ～ 12:30	見学	静岡県由比地区地すべり対策事業視察	荒木　孝宏	国土交通省中部地方整備局富士砂防事務所	0544-27-5262	日本語	由比地区直轄地すべり事業実施地区	JICA東京国際センター
	14:30 ～ 16:30		移動（静岡→東京）						
5/20(土)	～		アクションプラン作成／資料整理						JICA東京国際センター
5/21(日)	～		アクションプラン作成／資料整理						JICA東京国際センター
5/22(月)	10:00 ～ 12:00		移動（東京→神奈川）						ホテルボシュ
	13:00 ～ 17:30	見学	神奈川県急傾斜地崩壊対策／地すべり対策事業視察	新山　雅紀	神奈川県県土整備局 河川下水道部砂防海岸課	045-210-1111	日本語	田浦D地区、小坪2丁目A地区、大沢地区、城ヶ島地区	
5/23(火)	8:30 ～ 12:30	見学	神奈川県土砂災害対策事業視察	中野　優	神奈川県県土整備局 河川下水道部砂防海岸課	045-210-1111	日本語	大涌沢地区、須沢地区、箱根ジオミュージアム	JICA東京国際センター
	13:30 ～ 15:30		移動（神奈川→東京）						
	15:30 ～ 16:20	見学	赤木正雄像見学	渡　正昭	全国治水砂防協会 技術顧問	03-3261-8386	日本語	砂防会館	
5/24(水)	10:00 ～ 16:30	見学	防災総合体験学習	佐々木　央	(株)地球システム科学	03-3357-1761	日本語	東京臨海広域防災公園	JICA東京国際センター
5/25(木)	10:00 ～ 11:00	講義	予報業務の紹介	山田　拓	気象庁　予報部予報課 気象防災推進室	03-3211-4966	英語	気象庁	JICA東京国際センター
	11:00 ～ 11:30	見学	予報現業見学	及川　義教	気象庁　予報部アジア太平洋気象防災センター	03-3211-4966	英語	気象庁	
	11:40 ～ 12:20	見学	観測現業見学	吉村　広志	気象庁　観測部観測課観測システム運用課	03-3211-4966	英語	気象庁	
	14:00 ～ 16:30	実習	アクションプラン作成	佐々木　央	(株)地球システム科学	03-3357-1761		JICA東京国際センター SR302	
5/26(金)	9:00 ～ 14:45	実習	アクションプラン作成	佐々木　央	(株)地球システム科学	03-3357-1761		JICA東京国際センター SR302	JICA東京国際センター
	15:00 ～ 16:30	発表	アクションプラン発表会、閉講式	井上　陽一 佐々木　央	JICA地球環境部防災グループ (株)地球システム科学	03-3357-1761	英語		
5/27(土)	～		帰国						

＊研修監理員：宮崎　亜子

（b）　研修員リスト

組織名

和：スリランカ国災害管理省国家建築研究所

英：Ministry of Disaster Management, National Building Research Organisation

研修員氏名	役職
Ms. Vansanthan Nanthini	Senior Scientist (Engineer), Geotechnical Engineering Division
Mr. Wanasundara Mudiyanselage Abhitha D.W.	Scientist (Geologist), District Officer, Ratnapura, Landslide Research and Risk Management Division
Mr. Elgiriyage Rohana Bandula	Scientist (Geologist), District Officer, Galle, Landslide Research and Risk Management Division
Ms. Mallika Achchillage Kanchana Kumari	Scientist (Geologist), Landslide Research and Risk Management Division
Mr. Munasinghe Dayan Sanjeewa	Scientist (Town Planner), Human Settlement, Planning and Training Division

（c）　研修員との意見交換結果など、研修員個々の評価

Ms. Vansanthan Nanthini	土質試験室の見学は非常に参考になり、試験機自体は知っているものの実物を見るのは初めてのものも多くあった。NBRO は新庁舎の建設に伴い、試験室も更新予定のため、その際の設計や調達に活かしたい。 2 週間の研修では講義、現場視察を含めるとどうしても時間に制限があるため、数か月程度職員を派遣する形で共同研究のようなこともやってみたい。
Mr. Wanasundara Mudiyanselage Abhitha D.W.	現場視察ではスリランカで見ることのできない対策工も視察できた。日本では構造物対策と非構造物対策の両面からアプローチされており、それぞれで多くの実績を有している。スリランカでは予算面から構造物対策の適用が限られており、特に大規模な深礎工やアンカー工の実物を見る機会がない。実際に法枠工の施工現場で型枠を見ることができたのは興味深かった。
Mr. Elgiriyage Rohana Bandula	今回の研修では対策工の実施済みのところを多く見ることができたが、施工中の現場も視察できればなお良かった。本研修で学んだことを帰国後の活動に活かしていきたい。
Ms. Mallika Achchillage Kanchana Kumari	スリランカで短期専門家による土石流解析に関するワークショップに参加したが、今回の研修ではその補足として各種のパラメーター設定について、具体的な説明があり勉強になった。 NBRO も研究機関であるため、日本の研究機関とも協力して一つの課題に取り組めるような仕組みができることを期待する。
Mr. Munasinghe Dayan Sanjeewa	日本の災害対応や基準作りにはこれまでの災害履歴や記録に基づいた経験的、統計的な知見により実施されていることがよく分かった。スリランカでも災害様式の統一されていないため、そういった面でも改善の余地はあると感じた。もし様式が統一されていれば、災害対応や研究活動により活かしていくことが可能と思う。 土石流の危険地域設定および危険度評価は、NBRO の大きな課題の一つであるため、日本の手法を現地で適用するためにも過去の記録を取りまとめる必要がある。

添付資料　6

供与機材・携行機材調達実績

TCLMP

Technical Cooperation for Landslide Mitigation Project in the Democratic Socialist Republic of Sri Lanka

Ministry of Disaster Management (MDM) National Building Research Organisation (NBRO)

Japan International Cooperation Agency (JICA)

Office: 99/1, Jawalta Road, Colombo 5 (within NBRO Head Office)
Tel: (011) 2588964, 2503826, 2500354
Extension: 646

Our Ref: TCLMP-15-004 Date: 8th December 2014

Subject: Understanding of Equipment Delivered by JICA

JICA Expert Team procured the equipment No.7 to No.10 as per attached list according to the Item [28] in '3. Activities in the Project of the Work Plan (WP)'. The equipment is used by NBRO counterparts and JICA Expert Team only for the Technical Cooperation for Landslide Mitigation Project (TCLMP) purposes. Upon this delivery, NBRO shall be in charge of the management and maintenance of the equipment with his sole responsibility.

ENG. (Dr.) Asiri Karunawadena

Director General
National Building Research Organisation (NBRO)

30/7/2015

Ryuichi HARA

Team Leader
JICA Expert Team for TCLMP Project

Attachment 1: Equipment List

No.	Equipment	Initial Operator Guidance	Operational Guidance	Installation /Monitoring Guidance	Quantity	Remarks
1	***Desktop PC***	—	—	—	*1*	***1st Term in Sri Lanka***
2	***Laptop PC***	—	—	—	*5*	***1st Term in Sri Lanka***
3	***Multifunction Printer***	*Δ*	—	—	*5*	***1st Term in Sri Lanka***
4	***Projector***	—	—	—	*1*	***1st Term in Sri Lanka***
5	***Screen***	—	—	—	*1*	***1st Term in Sri Lanka***
6	Underground Water Gauge (automatic transmission record type)	Δ	Δ	◎	3	1st Term in Japan
7	Extensometer (automatic record type)	Δ	Δ	◎	7	1st Term in Japan
8	Pipe Strain Gauge with piezometer (automatic record type, with water gauge)	Δ	Δ	◎	2	1st Term in Japan
9	Inclinometer guide pipe	Δ	Δ	◎	3	1st term in Japan
10	Boring Machine	◎	◎	—	1	1st Term by JICA
11	Air Compressor	◎	Δ	—	1	2nd Term

◎: Necessary Δ: As necessary —: Unnecessary／Not covered

1st Term: Oct. 2014 - Nov. 2015 2nd Term: Jan. 2016 - Aug. 2018 As of Jul. 2015

Attachment 2: Details of equipment

Monitoring Equipment

No.	Item	Model	Quantity	Unit	Remarks
6	Piezometer	LG-001E(English version)	3	items	
	Storage box of piezometer	Plastic Box-12C	3	items	
	Sensor of undergroundwater level	DS-1(50m cable)	3	items	
7	Extensometer	SLG-10E(English version)	7	items	
	Storage box of extensometer	Wooden	7	items	
	Controller	CT-1E(English version)	1	items	
	CF Memory Card Set	256MB	1	items	
8	Straingauge Pipe/Piezometer	LG-301E(English version)	2	items	
	Strage box of straingauge Pipe and Piezometer	Plastic Box-18BC	2	items	
	Pipe Straingauge 20m	20m	1	set	20m * 1 hole
	Pipe Straingauge 40m	40m	1	set	40m * 1 hole
9	Guidepipe of inclinometer	KBF-31-3(3m/each, Total 75m)	25	pcs	40m * 1 hole
	Guidepipe of inclinometer	KBF-31-1(1m/each, Total 5m)	5	pcs	20m * 2 holes
	Socket	KBF-32	27	pcs	Total 80m
	Cap	KBF-34	6	pcs	
	Cable holder	KBF-37	3	pcs	
	Rivet	KBF-38	3	packs	
	Riveting machine	KBF-39	3	pcs	

TCLMP エアーコンプレッサー検査報告書

2017 年 8 月 1 日

１．検査者

鵜澤　幸二（土砂災害対策強化プロジェクト　調達／入札評価）

Mr. N.M.L.B. Nawarathna (NBRO Scientist / Geologist: NBRO 機材責任者)

Mr. G. Ruhunuge (NBRO Store Keeper: NBRO 在庫管理責任者)

Mr. Gunawaradana (NBRO Drilling superintend : NBRO コンプレッサー操作責任者)

２．日時

7 月 25 日：開梱及び機材の状態・数量検査

7 月 26 日：現地代理店エンジニアの確認

7 月 31 日：エアーコンプレッサーの試運転・操作確認・維持管理指導

３．機材検査概要

１）機材の状態及び数量確認作業

プロジェクト専門家は NBRO 機材責任者及び、在庫管理責任者の立会いのもと、7 月 25 日に計 3 アイテムを開梱し、機材の状態と数量の検査を実施した。梱包状態は良好で、機材に錆や損傷は確認されなかった。また、数量の欠品もなく調達機材一式に問題はみられなかった。

7 月 26 日にスリランカの現地代理店「General Sales 社」のエンジニアがコンプレッサーの状態を確認した。

２）試運転及び維持管理指導

7月31日に、プロジェクト専門家はNBROの機材責任者とコンプレッサー操作責任者の立ち合いのもと、コンプレッサーの試運転と操作方法の確認を行った。また NBRO の機材責任者とコンプレッサー操作責任者に対し、以下の維持管理・安全操作指導を行った。

- 専門家の指導によって作成された「ログブック」に基づく維持管理方法の確認
- 維持管理マニュアル、パーツカタログの確認
- 不具合発生時の対応方法（現地代理店とメーカー担当者の連絡先）
- 現地代理店を通したスペアパーツの注文方法
- エアーバルブ及び、高圧エアーホースの取扱い方法
- 非常停止スイッチの操作方法

３）検査・技術指導報告

7 月 31 日の試運転、操作説明、維持管理指導の終了後に、プロジェクト専門家は NBRO の所長に機材の検査及び技術指導について報告した。8 月 3 日に JICA スリランカ事務所に業務完了報告を行った。

添付資料

① 写真

② 機材検収リスト

機材の状態及び数量確認

JICA ステッカーの貼付（前面・右側面）

JICA ステッカーの貼付（後面・左側面）

右側面

左側面

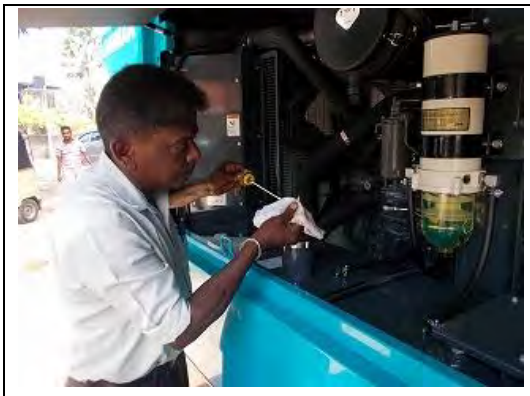
部品検品作業

現地代理店によるコンプレッサー状態確認１

現地代理店によるコンプレッサー状態確認２

現地代理店によるコンプレッサー状態確認３

操作説明・維持管理指導



始業前点検（エンジンオイル）

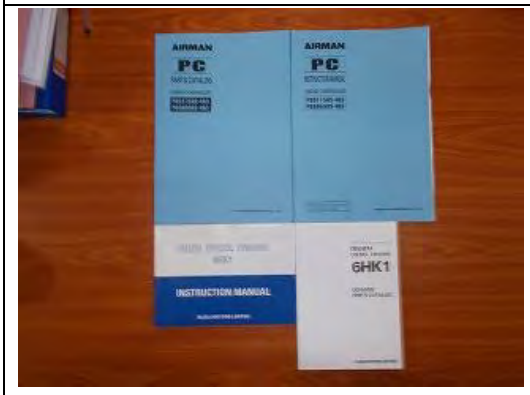
始業前点検（コンプレッサーオイル）

牽引部分の確認

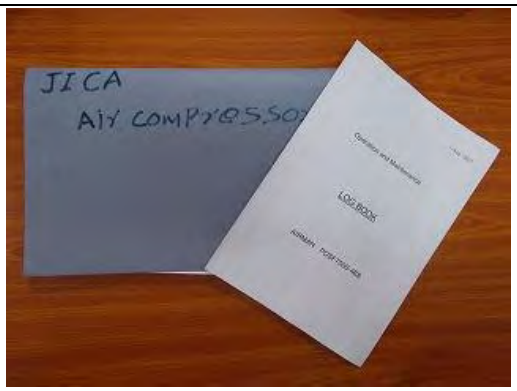
寒冷地始動装置の操作指導

非常停止スイッチの操作指導

コントロールモニターの操作指導



操作マニュアル及び部品カタログ



NBRO コンプレッサーファイル及びログブック

TEC INTERNATIONAL INC.

3rd Fl., Zuicho Building
1-15-15, Kudan-kita, Chiyoda-ku,
Tokyo 102-0073 Japan
Tel : 81-3-6261-5670 (Rep.)
Fax : 81-3-6261-5794 (Rep.)

PACKING LIST

Date of Invoice	Invoice No.
2-Jun-17	TF-16-25
Country of Destination	**Remarks**
Sri Lanka	

Shipper :
TEC INTERNATIONAL INC. on behalf of JICA
3rd Floor, Zuicho Building, 1-15-15, Kudan-kita, Chiyoda-ku, Tokyo 102-0073, Japan
Tel : 81-3-6261-5670, Fax : 81-3-6261-5794

Consignee
National Building Research Organisation (NBRO)
No.99/1, Jawatta Road, Colombo 05, Sri Lanka
Tel: +94-11-2505149 Fax: +94-2502611

Notify party:
①Japan International Cooperation Agency (JICA)
JICA Sri Lanka Office
10th & 13th Floors, DHPL Building,No.42,
Navam Mawatha,Colombo02, Sri Lanka
TEL: +94-11-2303700, 2300470,
FAX: +94-11-2303692, 2300473
②Same as consignee

Means of Transport and Route: By Sea

Shipped per	On or about
LYDIA V.0729-013A	11-Jun-17
From	**Via**
Yokohama, Japan	Colombo, Sri Lanka

To
Project sites in Colombo, Sri Lanka

Terms of Payment
No commercial value
Value for customs purpose only

Marks and Numbers	Number and Kind of Packages	Description of Goods	Quantity	N/W (kgs)	G/W(kgs)	M3
As per attached sheet		The Equipment for Technical Cooperation for Landslide Mitigation Project in Sri Lanka Air Compressor & accessories Commodity details are as per attached sheets "The above mentioned equipment is to be donated under Technical Cooperation by the Government of Japan."				
TOTAL	THREE (3) PACKAGES ONLY (One Bare & Two Pallets Only)			**3431.00**	**3,471.00**	**22.288**

TEC INTERNATIONAL INC.

Atsushi Umehara
General Manager

17/07/25

Checked by:
N.M.L.B. Nawarathna
Scientist / Geologist
National Building Research Organisation

25/7/2017

Checked by:
Koji UZAWA
Procurement / Evaluation of bidding
JICA / TCLMP

G. Ruhunuge

Received by:
G.P. Ruhunuge
Store Keeper
National Building Research Organisation

STORE KEEPER
NATIONAL BUILDING RESEARCH ORGANISATION
99/1, JAWATTE ROAD,
COLOMBO 05.

C/No.	Item No.	Packing Style	Description	Model / Part No.	Q'ty	N/Weight	G/Weight	M'Ment	CBM
1/3	1	BARE	Air compressor	PDSF750S-4B3	1	3,210	3,210	415x220x220	20.086
2/3	1	PALLET	Air delivery hose		1	135	155	110x110x50	0.605
3/3	1	PALLET	Spare parts		1	86	106	110x110x132	1.597
			total			3431.0	3471.0		22.288

Checked by:
N.M.L.B. Nawarathna
Scientist / Geologist
National Building Research Organisation

Checked by:
Koji UZAWA
Procurement / Evaluation of bidding
JICA / TCLMP

Received by:
G.P. Ruhunuge
Store Keeper
National Building Research Organisation

STORE KEEPER
NATIONAL BUILDING RESEARCH ORGANISATION
99/1, JAWATTE ROAD,
COLOMBO 05.

No.	Description	Brand/Manufacturer	Model / Part No.	Q'ty	U/Price	Amount
1	Air compressor, High pressure type	Hokuetsu Industries	PDSF750S-4B3	1	4,822,000	4,822,000
2	Accessories:					
	Operation instruction manual (English)	Hokuetsu Industries	-	1	6,000	6,000
	Parts catalog (English)	Hokuetsu Industries	-	1	7,000	7,000
	Air delivery hose	Hokuetsu Industries	-	1	263,000	263,000
	Emergency stop mechanism	Hokuetsu Industries	-	1	125,000	125,000
	Engine instruction manual (English)	Hokuetsu Industries	-	1	7,200	7,200
	Engine parts catalog (English)	Hokuetsu Industries	-	1	4,220	4,220
3	Spare Parts:					
	ENGINE OIL FILTER		41291-00500	9	5,200	46,800
	AIR ELEMENT, OUTER(ENGINE)		32143-15300	4	29,500	118,000
	AIR ELEMENT, INNER(ENGINE)		32143-15200	4	13,900	55,600
	AIR ELEMENT, OUTER(COMP)		32143-16000	4	45,500	182,000
	AIR ELEMENT, INNER(COMP)		32143-15901	4	22,700	90,800
	COMPRESSOR OIL FILTER		37438-09600	5	15,500	77,500
	ELEMENT KIT, FUEL		11324-0441	8	3,710	29,680
	ELEMENT, FUEL PRE-FILTER		43541-01400	8	21,900	175,200
	FOB total					**6,010,000**

17/07/25.

Checked by:
N.M.L.B. Nawarathna
Scientist / Geologist
National Building Research Organisation

Checked by:
Koji UZAWA 25/7/2017
Procurement / Evaluation of bidding
JICA / TCLMP

G. Ruhunuge

Received by:
G.P. Ruhunuge
Store Keeper
National Building Research Organisation

STORE KEEPER
NATIONAL BUILDING RESEARCH ORGANISATION
99/1, JAWATTE ROAD,
COLOMBO 05.

Exchange sheet

No.	Description	Brand / Parts number	Qty	U/Price	Amount (JPY)	Amount (LKR*)
1	Air compressor, High pressure type				4,822,000	6,654,360
2	Accessories					
	Operation instruction manual				6,000	8,280
	Parts catalog				7,000	9,660
	Air delivery hose				263,000	362,940
	Emergency stop mechanism				125,000	172,500
	Engine instruction manual				7,200	9,936
	Engine parts catalog				4,220	5,824
3	Spare parts					
	ENGINE OIL FILTER	41291-00500	9	5,200	46,800	64,584
	AIR ELEMENT, OUTER(ENGINE)	32143-15300	4	29,500	118,000	162,840
	AIR ELEMENT, INNER(ENGINE)	32143-15200	4	13,900	55,600	76,728
	AIR ELEMENT, OUTER(COMP)	32143-16000	4	45,500	182,000	251,160
	AIR ELEMENT, INNER(COMP)	32143-15901	4	22,700	90,800	125,304
	COMPRESSOR OIL FILTER	37438-09600	5	15,500	77,500	106,950
	ELEMENT KIT, FUEL	11324-0441	8	3,710	29,680	40,958
	ELEMENT, FUEL PRE-FILTER	43541-01400	8	21,900	175,200	241,776
	TOTAL				6,010,000	8,293,800

*Exchange rate 1JPY : 1.38 LKR

Ref. FX Exchange Rate.com (http://lkr.jp.fxexchangerate.com/) 26/Jul./2017

Check List

Parts No.	Parts Name	①
32143 16000	AIR ELEMENT	2
37438 09600	OIL FILTER	5

星野

Check List

Parts No.	Parts Name	②
41291 00500	OIL FILTER	9
32143 16000	AIR ELEMENT	2

星野

Check List

Parts No.	Parts Name	③
32143 15300	AIR ELEMENT	2
32143 15200	AIR ELEMENT	4
43541 01400	FUEL Pre-FILTER	8

星野

Check List

Parts No.	Parts Name	④
32143 15300	AIR ELEMENT	2
32143 15901	AIR ELEMENT	4
113240 0441	FUEL FILTER	8

星野

添付資料　7

合同調整会議議事録

添付資料　7-1

合同調整会議議事録
第１回 JCC

MINUTES OF MEETING

ON

JOINT COORDINATION COMMITTEE (JCC)

FOR

TECHNICAL COOPERATION PROJECT

FOR

"IMPROVING OF METEOROLOGICAL OBSERVATION, WEATHER FORECASTING AND DISSEMINATION"

AND

"LANDSLIDE MITIGATION PROJECT"

IN

THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

The series of discussions on the above captioned project among the officials concerned of the Government of Sri Lanka and the Japan International Cooperation Agency (JICA) Sri Lanka Office have been conducted under chairmanship of Ms. S M. Mohamed, Secretary to the Ministry of Disaster Management.

As the result of the discussions, both sides have confirmed the main items described in the attached sheet.

Colombo, October , 2014

ATTACHMENT

1. Date and Venues of Joint Coordination Committee

   1) Date: Tuesday, October 14th 2014

   2) Time: 14:00hrs to 17:00hrs

   3) Venue: Conference Room of Ministry of Disaster Management

   4) Agenda: As per attached.

2. Main Points Discussed

   1) Welcome Address by Secretary to the Ministry of Disaster Management

      Secretary, Ministry of Disaster Management welcomed JICA officials, JICA Experts and relevant officers from Department of Meteorology, National Building Research Organization and Disaster Management Centre.

      She appreciated the past cooperation project from Japan and JICA, which fulfilled the gap existed for Disaster Risk Reduction. Since the project formulation took several years after the Government of Sri Lanka has decided to implement these two projects, she expects that the project will achieve producing the satisfactory outcomes. She also expressed that meaningful and fruitful discussion for firm implementation of the project is required for the success of the project.

      Therefore, she appreciates to organize JCC every quarter and requested to conduct On-The-Job (OJT) Training to relevant officers to maintain the sustainability of the projects. Based on the signed Record of Discussion (R/D), she wants JICA Experts to transfer their skills and knowledge to counterpart to sharpen their skills.

   2) Opening Address by JICA Chief Representative

      JICA Chief Representative appreciated cooperation between Sri Lanka and Japan to inaugurate both two projects. While thanking all the related officers, he expects smooth and successful implementation of the Project as these two projects are mentioned in the Joint Statements of Japanese Government and Sri Lankan Governments.

   3) Explanation of the Work Plan on the Project for Improving of Meteorological Observation, Weather Forecasting and Dissemination

      Sri Lankan side indicated following points for successful implementation of the project.

- ❖ The importance of procurement of the required equipment for the project as indicated in the Record of Discussions (R/D).
- ❖ Request to provide the ID and password of data for SATAID by Japan Meteorological Agency through JICA.
- ❖ To keep the first two years for mainly the project implementation and the third year for monitoring/verification.

JICA Sri Lanka responded to the above inquiries as follows.

- JICA Sri Lanka will reconfirm the equipment to be procured in line with R/D.
- JICA Sri Lanka will contact JMA through JICA HQ and ask for ID and password of SATAID data.
- JICA Expert team indicated the schedule of weather forecasting and warning activities has been considered so that the first two years for mainly the project implementation and the third year for mainly verification of the accuracy and appropriateness.
- JICA expert team requested hazard information available at NBRO and they agreed to provide them.

4) Explanation of the Work Plan on the Technical Cooperation for Landslide Mitigation Project

Sri Lankan side indicated following points for the successful implementation of the project:

- ❖ To expedite the survey and design process in order to start physical construction before the next monsoon season, which starts next April.
- ❖ Including the DMC staff to conduct OJT training on Early Warning.
- ❖ Conduct trainings in Japan in the early first and second year, rather than having one in year 2016 and 2017.
- ❖ Since the four pilot sites are ear-marked by JICA out of 36 places approved by the cabinet, Sri Lankan side wishes to have the early implementation of the physical project as the pattern of the rainfall changes.

JICA Sri Lanka responded to the above inquiries as follows.

- JICA and JICA Expert team will try their best to meet the request from Sri Lankan side for expedite physical works.
- JICA and JICA Expert team agreed to include DMC staff to conduct OJT on Early Warnings.
- JICA Expert team will reconsider the timing of trainings in Japan.

- JICA Expert team asked about the procedure of utilizing UAV for surface observation. Sri Lankan side agrees to take necessary arrangement for UAV usage with Ministry of Defense and Urban Development, Sri Lankan Air Force and Civil Aviation Authority.

5) Revision of Project Design Matrix (PDM)

While the percentage mentioned in the revised PDM is set below 100%, based on the request of Sri Lankan Side, JICA Expert team assured to conduct OJT to all the staff concerned in the project. Proposed revision of the PDM was approved as per attached (Annex 2).

6) Project Launch

Both the Sri Lankan Side and JICA side agreed to organize Project Launch for both project. Date of the Launch should be late November or early December as budget related works finish in middle of November.

Both sides agreed to have further discussion to finalize the date.

7) Next JCC Meeting

Chairperson has informed that next JCC meeting to be organized in January 2015.

Annex:

1. Agenda of JCC
2. PDM version 1
3. List of Attendants

添付資料　7-2

合同調整会議議事録
第２回 JCC（中間評価）

MINUTES OF MEETINGS

BETWEEN

THE JAPANESE MID-TERM EVALUATION TEAM AND THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

ON

THE JAPANESE TECHNICAL COOPERATION

FOR

TECHNICAL COOPERATION FOR LANDSLIDE MITIGATION PROJECT

The Japanese Mid-term Evaluation Team (hereinafter referred to as "the Team"), organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Mr. Yoichi Inoue, Acting Director of Disaster Risk Reduction Team 1, Global Environment Department, visited the Democratic Socialist Republic of Sri Lanka from September 22 to October 12, 2016 for the purpose of conducting the Mid-term evaluation on the Japanese technical cooperation for technical cooperation for land slide mitigation project (hereinafter referred to as "the Project").

During its stay, both the Team and the Sri Lankan side formulated the Joint Evaluation Team, exchanged the views and had a series of discussions on the Project with the Sri Lankan authorities related and concerned. As a result of the discussions, the Team submitted a report as attached (Annex-1) and both Sri Lankan and Japanese sides (hereinafter referred to as "Both sides") agreed upon the descriptions of the report and the attached document.

Colombo, October 12, 2016

井上陽一

YOICHI INOUE
Team Leader
Mid-Term Evaluation Team
Japan International Cooperation Agency (JICA)

S. S. MIYANAWALA
Secretary
Ministry of Disaster Management

DR. ASIRI KARUNAWARDENA
Director General
National Building Research Organisasion
Ministry of Disaster Management
the Democratic Socialist Republic of
Sri Lanka

ATTACHED DOCUMENT

1. **Joint Mid-term Evaluation:**

Both sides agreed the result of the Joint Mid-term Evaluation as Annex-1.

2. **Recommendations and lesson learned:**

A series of recommendations and lessons learned are written in the Report. Below points are to be highlighted by the Team because of its importance for the remaining period of the Project.

Recommendations:

(1) Measures to prevent unplanned construction works

During the mid-term review, JICA experts and NBRO discussed and agreed on the measures to prevent unplanned construction works as follows.

a. Permanent assignment of at least one supervisor per project site

There were days when none of a TCLMP assistant and a NBRO site engineer or JICA experts were present at the project sites. This caused the unplanned construction.

In principle, NBRO is requested to make sure that a site engineer is always present at the project sites. This is also important from the perspective of technology transfer on the construction supervision. At the same time, since it can happen for him or her to be absent due to unavoidable circumstances (e.g. sickness), JICA experts and NBRO are requested to ensure that at least one supervisor (a TCLMP assistant, a NBRO site engineer or a JICA expert) always supervises the construction work at the project sites.

b. Prior approval of any change to the construction plan

In order to make sure that countermeasures are constructed according to the approved construction plan, NBRO and JICA experts are requested to ensure that the contractors submit a request letter when any change to the plan is necessary and all the changes are documented with photos. Approval should be done in the written letter and in timely manner. Documents approval procedure were agreed between NBRO and JICA experts as attached in Appendix-1, and prior approval should be done in accordance with the agreed procedure.

(2) Improvement of communication

Better and faster communication among JICA experts, NBRO and the contractors is indispensable to avoid further delay and unplanned construction works. In order to improve communication, daily onsite meeting among a TCLMP assistant, a site engineer and field office staff of NBRO and the contractors is highly recommended in order to confirm the progress, the quality of work, daily works, technical matters and any concerns before commencement of the daily works. In addition, JICA experts are requested to have a monthly meeting with NBRO

headquarters staff, a TCLMP assistant, a site engineer and field office staff of NBRO and the contractors in order to confirm the progress, the quality of work, technical matters and any concerns. In order to respond to a change of the construction plans in a timely manner, NBRO is recommended to take a step to shorten the time to issue an approval letter as per agreed procedure attached in Appendix-1. In addition, all parties should try to avoid miscommunication. Important communication related to decision making should be done in written document and in timely manner.

ANNEX:

ANNEX-1: Joint Mid-term Evaluation Report

APPENDIX:

APPENDIX-1: Flow of the letter

APPENDIX: Flow of the letter

Flow of the letter 【include the cost changing】

①Proposal letter from the Contractor

The Contractor	→	To : The Engineer
	→	CC : JICA

・Technical Change and the reason

・Change of Quantity (Increase/Decrease)

Initial quantity and changed quantity are should be shown (for contrast)

・Attachment for unit price and total cost (necessary)

②Letter of Approval / improvement request / non approval Letter

The Engineer	→	To : The Contractor
	→	CC : JICA

Noted at the letter end " Change of the cost will be reviewed by JICA office"

After the Approval by the Engineer

③Request for the Rate Variation , Quantity Change

The Contractor	→	To : JICA
		CC : The Engineer

Show the unit price and total cost

④Acceptance for the request

JICA	→	To : The Contractor
		CC : The Engineer

After above process, the contractor can start the proposed site work.

Do not start the work for modified drawing or increased quantity before the JICA's acceptance.

添付資料　7-3

合同調整会議議事録
第３回 JCC（終了時評価）

MINUTES OF MEETINGS

BETWEEN

THE JAPANESE TERMINAL EVALUATION TEAM AND THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

ON

TECHNICAL COOPERATION FOR LANDSLIDE MITIGATION PROJECT

The Japanese Terminal Evaluation Team (hereinafter referred to as "the Team"), organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Mr. Yuki Aratsu, Senior Assistant Director, Global Environment Department, visited the Democratic Socialist Republic of Sri Lanka from September 14 to October 4, 2017 for the purpose of conducting the Terminal evaluation on technical cooperation for land slide mitigation project (hereinafter referred to as "the Project").

During its stay in Sri Lanka, both the Team and the Sri Lankan side formulated the Joint Evaluation Team, exchanged the views and had a series of discussions on the Project with the Sri Lankan authorities related and concerned. As a result of the evaluation works and discussions, the Team submitted a report as attached (Annex-1) and both Sri Lankan and Japanese sides (hereinafter referred to as "Both sides") agreed upon the descriptions of the report and the documents attached hereto.

Colombo, October 4, 2017

YUKI ARATSU
Team Leader
Terminal Evaluation Team
Japan International Cooperation Agency（JICA）

M. KINGSLY FERNANDO
Secretary
Ministry of Disaster Management

ASIRI KARUNAWARDENA
Director General
National Building Research
Organization(NBRO)
Ministry of Disaster Management

ATTACHED DOCUMENT

1. Joint Terminal Evaluation:

Both sides agreed on the result of the Joint Terminal Evaluation as Annex-1.

2. Modification of Project Design Matrix (PDM)

Both sides agreed on modified PDM as Annex-2.

3. Recommendations and lesson learned:

A series of recommendations and lessons learned are written in the **Joint Terminal Evaluation Report in Annex1**. The following points were highlighted by the Team and necessary measures were agreed by both sides to secure the sustainability of the Project.

a. Assignment of responsible personnel at NBRO local offices

The Team pointed out the necessity to check the constructed facilities at 3 pilot sites (referred to as "the Facilities") during the defects liability period of the contract(s) until August 2018.

NBRO agreed to assign responsible personnel at local offices in charge of the Facilities and inform to JICA Sri Lanka office immediately, if a defect appears or damage occurs.

b- Proper maintenance of the Facilities after the completion of the Project

The Team pointed out the importance of the continuous monitoring and proper maintenance of the Facilities after the completion of the Project so as to secure sustainability. NBRO agreed to make monitoring with a check sheet at least two times per year after the rainy seasons (monsoons), especially after heavy rainfall and maintain the Facilities properly by themselves. NBRO also agreed that whenever necessity arises, such as any major damages occur, NBRO should inform it with its actions to be taken to JICA Sri Lanka Office.

c-Utilization and recognition of a manual on sediment disaster countermeasures as an institutional publication

JICA experts and NBRO will jointly prepare a manual on sediment disaster countermeasures by the end of the Project, which includes lessons learned through the Project. In order to widely share the knowledge and technology transferred by the Project and sustain them. NBRO agreed to fully utilize the manual and widely share it as an institutional publication.

Annex-1: Joint Terminal Evaluation Report

Annex-2: Project Design Matrix Ver. 3.0

添付資料　8

機材活用計画

Utilization Plan for Drilling Machine - 2018/2019

No	Project Description	2018									2019
		April	May	June	July	August	September	October	November	December	January
1	Slope stability assessment at Attanagalla site										
2	Hanthana IFS site										
3	Soil Investigation and stability assessment at Uva Wellassa University site										
4	Installation of monitoring equipments at Watawala landslide										

Utilization Plan for Air Compressor - 2018/2019

No	Project Description	2018									2019
		April	May	June	July	August	September	October	November	December	January
1	Nurses Training School, Kandy										
2	Hanthana IFS Site										
3	Landslide Mitigation projects at Welimada and Badulla										

1 / Aug. / 2017

Operation and Maintenance

LOG BOOK

AIRMAN PDSF750S-4BS

Procedures

1. Towing the Machine

WEIGHT = 3,570kg (3.6ton)

Check

Tire pressure and Nuts

Connection of Drawbar

Speed

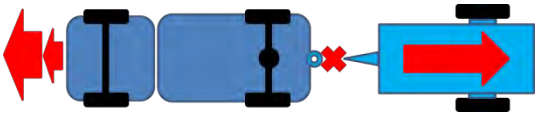
Maximum 20km/h

Avoid

Abrupt steering

Sudden Braking

Rapid Acceleration



2. Before operation

Parking

Chocks on the wheel

Pull the parking brake

Only for Parking

Inspection

Daily inspection

Follow the "Check sheet"

Starting

Discharge air pressure "0M/Pa"

Service valve "Fully closed"

Warm up time "5minutes"

Turbo charger engine

3. After operation

Stopping

Service valve “Fully closed”

Discharge residual pressure

Cooldown time “5minutes”

Turbo charger engine

Inspection

Check the all condition

Check the Hour meter for

Periodic maintenance

Cleaning

Body and Undercarriage

Hose and Equipment

4. Any problems

Following the “AIRMAN Instruction manual”

5. Fuel consumption

Fuel tank capacity: 300liter

Load	Liter/hour
100%	41.9
70%	27.8
50%	23.7
0%	19.9

OPERATION LOG

AIRMAN PDSF750S-4BS

Operation date	Operation place	Operation time		Hour meter		Daily operation hours (b)-(a)	Discharge air pressure (M/Pa)	Rated RPM (rpm/min)	Discharge air temperature (℃)	Coolant temperature (℃)	Remarks (Inspection/Parts change history etc.)
		Start time	Finish time	Start (a)	Finish (b)						
/ /		:	:								
/ /		:	:								
/ /		:	:								
/ /		:	:								
/ /		:	:								
/ /		:	:								
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Periodic Inspection List

Item marked ○shall be carried by NBRO.
Item marked ● contact AIRMAN official distributer.

	Maintenance	Daily	50	250	300	500	1,000	2,000	3,000	6,000	12,000
Engine	Check engine oil level	○									
	Check coolant level	○									
	Check fuel	○									
	Drain fuel tank	○									
	Drain and check in fuel pre-filter	○									
	Check for looseness in pipe connectors, terminal and tear in wiring	○									
	Check belt tension	○									
	Change engine oil		○	○							
	Change engine oil filter		○	○							
	Check battery electrolyte			○							
	Check and clean clogging air filter element			○							
	Change fuel filter element			○							
	Change element of the fuel pre-filter			○							
	Change air filter element					○					
	Clean the strainer provided inside the engine feed pump					○					
	Change coolant						○/2Y				
	Clean outside of the radiator and inter cooler						○				
	Clean inside of radiator						●				
	Change inter cooler hose							●/2Y			
	Change fuel hose							●/2Y			
	Clean inside of fuel tank							●			
	Change radiator hoses								●/2Y		
	Change wiring harness									●	
Compressor	Check compressor oil level	○									
	Drain separator receiver tank	○									
	Check for looseness in pipe connecting part, wear and tear of pipe	○									
	Check oil, water, fuel and air leak	○									
	Check functions of all instruments and devices	○									
	Conduct the performance check of the safety valve	○									
	Check and clean clogging air filter element			○							
	Change compressor oil				○	○					

	Change compressor oil filter				○	○					
	Change air filter element					○					
	Clean strainer in the scavenging orifice					○					
	Clean outside of the oil cooler						○				
	Change nylon tubes							●/2Y			
	Change oil separator							●			
	Change the O-ring of the unloader								●/3Y		
	Check and change the unloader bushing								●/3Y		
	Change pressure regulator diaphragm								●/3Y		
	Change speed regulator diaphragm								●/3Y		
	Change rubber hoses								●/3Y		
	Check consumable parts of the auto-relief valve								●/3Y		
	Change consumable parts of the vacuum relief valve								●/3Y		
	Performance check of pressure control valve									●	
	Check the O-ring and piston of pressure control valve									●	
	Change rubber coupling										●
	Change oil seal / bearing										●
	Change solenoid valve										●
Undercarriage	Check and confirm that the nuts with which tires are fixed are properly tightened	○									
	Check and confirm the specified tightening torque of the nuts with which tires are fixed			○/3M							
	Supply grease to trailer hub bearing						○				
	Greasing axle						○				

Periodic Inspection schedule (1)

Item marked ○shall be carried by NBRO. Item marked ● contact AIRMAN official distributer.

	Maintenance	50	250	300	500	750	1,000	1,250	1,500	1,750	2,000	2,250	2,500	2,750	3,000
Engine	Change engine oil (CD-SAE10W-30)	○	○		○	○	○	○	○	○	○	○	○	○	○
	Change engine oil filter	○	○		○	○	○	○	○	○	○	○	○	○	○
	Check battery electrolyte		○		○	○	○	○	○	○	○	○	○	○	○
	Check and clean clogging air filter element		○		○	○	○	○	○	○	○	○	○	○	○
	Change fuel filter element		○		○	○	○	○	○	○	○	○	○	○	○
	Change element of the fuel pre-filter		○		○	○	○	○	○	○	○	○	○	○	○
	Change air filter element				○		○		○		○		○		○
	Clean the strainer provided inside the engine feed pump				○		○		○		○		○		○
	Change coolant						○				○				○
	Clean outside of the radiator and inter cooler						○				○				○
	Clean inside of radiator						●				●				●
	Change inter cooler hose										●				
	Change fuel hose										●				
	Clean inside of fuel tank										●				
	Change radiator hoses														●
	Change wiring harness														
Compressor	Check and clean clogging air filter element		○		○	○	○	○	○	○	○	○	○	○	○
	Change compressor oil (Mobil Rarus SHC1025) (VG46)			○	○		○		○		○		○		○
	Change compressor oil filter			○	○		○		○		○		○		○
	Change air filter element				○		○		○		○		○		○
	Clean strainer in the scavenging orifice				○		○		○		○		○		○
	Clean outside of the oil cooler						○				○				○
	Change nylon tubes										●				
	Change oil separator										●				
	Change the O-ring of the unloader														●
	Check and change the unloader bushing														●
	Change pressure regulator diaphragm														●
	Change speed regulator diaphragm														●
	Change rubber hoses														●
	Check consumable parts of the auto-relief valve														●
	Change consumable parts of the vacuum relief valve														●
Undercarriage	Check and confirm the specified tightening torque of the nuts with which tires are fixed		○		○	○	○	○	○	○	○	○	○	○	○
	Supply grease to trailer hub bearing						○				○				○
	Greasing axle						○				○				○

Periodic Inspection schedule (2)

Item marked ○shall be carried by NBRO. Item marked ● contact AIRMAN official distributer.

	Maintenance	3,250	3,500	3,750	4,000	4,250	4,500	4,750	5,000	5,250	5,500	5,750	6,000	12,000
Engine	Change engine oil (CD-SAE10W-30)	○	○	○	○	○	○	○	○	○	○	○	○	
	Change engine oil filter	○	○	○	○	○	○	○	○	○	○	○	○	
	Check battery electrolyte	○	○	○	○	○	○	○	○	○	○	○	○	
	Check and clean clogging air filter element	○	○	○	○	○	○	○	○	○	○	○	○	
	Change fuel filter element	○	○	○	○	○	○	○	○	○	○	○	○	
	Change element of the fuel pre-filter	○	○	○	○	○	○	○	○	○	○	○	○	
	Change air filter element		○		○		○		○		○		○	
	Clean the strainer provided inside the engine feed pump		○		○		○		○		○		○	
	Change coolant				○				○				○	
	Clean outside of the radiator and inter cooler				○				○				○	
	Clean inside of radiator				●				●				●	
	Change inter cooler hose				●								●	
	Change fuel hose				●								●	
	Clean inside of fuel tank				●								●	
	Change radiator hoses												●	
	Change wiring harness												●	
Compressor	Check and clean clogging air filter element	○	○	○	○	○	○	○	○	○	○	○	○	
	Change compressor oil (Mobil Rarus SHC1025) (VG46)		○		○		○		○		○		○	
	Change compressor oil filter		○		○		○		○		○		○	
	Change air filter element		○		○		○		○		○		○	
	Clean strainer in the scavenging orifice		○		○		○		○		○		○	
	Clean outside of the oil cooler				○				○				○	
	Change nylon tubes				●								●	
	Change oil separator				●								●	
	Change the O-ring of the unloader												●	
	Check and change the unloader bushing												●	
	Change pressure regulator diaphragm												●	
	Change speed regulator diaphragm												●	
	Change rubber hoses												●	
	Check consumable parts of the auto-relief valve												●	
	Change consumable parts of the vacuum relief valve												●	
	Performance check of pressure control valve												●	
	Check the O-ring and piston of pressure control valve												●	
	Change rubber coupling													●
	Change oil seal / bearing													●
	Change solenoid valve													●
Undercarriage	Check and confirm the specified tightening torque of the nuts with which tires are fixed	○	○	○	○	○	○	○	○	○	○	○	○	
	Supply grease to trailer hub bearing				○				○				○	
	Greasing axle				○				○				○	

Daily Inspection check sheet

Good : ✔ Bad : X

AIRMAN PDSF750S-4BS

	Item number / Contents	Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Engine	1 Check engine oil level																																
	2 Check coolant level																																
	3 Check fuel																																
	4 Drain fuel tank																																
	5 Drain and check in fuel pre-filter																																
	6 Check for looseness in pipe connectors, terminal and tear in wiring																																
	7 Check belt tension																																
Compressor	8 Check compressor oil level																																
	9 Drain separator receiver tank																																
	10 Check for looseness in pipe connecting part, wear and tear of pipe																																
	11 Check air leakage																																
	12 Check functions of all instruments and devices																																
	13 Conduct the performance check of the safety valve																																
U/C	14 Check and confirm that the nuts with which tires are fixed are properly																																
Inspector																																	
Remarks																																	

Countermeasures (When you filled in "X", fill in this column with checked item number, date and method.)

Air compressor Periodic inspection check sheet

Date	Model	Reg. No.	Hour meter	Checked by	Engineer sig.
			h		

✔	OK	×	Change	**A**	Adjust	**C**	Clean up	**T**	Tighten	**L**	Lubricant

Check		Engine	Qty.
	250	Change engine oil (CD-SAE10W-30)	L
	250	Change engine oil filter	
	250	Check battery electrolyte	
	250	Check and clean clogging air filter element	
	250	Change fuel filter element	
	250	Change element of the fuel pre-filter	
	500	Change air filter element	
	500	Clean the strainer provided inside the engine feed pump	
	1,000	Change coolant	
	1,000	Clean outside of the radiator and inter cooler	
	1,000	Clean inside of radiator	
	2,000	Change inter cooler hose	
	2,000	Change fuel hose	
	2,000	Clean inside of fuel tank	
	3,000	Change radiator hoses	
	6,000	Change wiring harness	

Check		Compressor	Qty.
	250	Check and clean clogging air filter element	
	500	Change compressor oil (Mobil Rarus SHC1025) (VG46)	L
	500	Change compressor oil filter	

Check		Compressor	Qty.
	500	Change air filter element	
	500	Clean strainer in the scavenging orifice	
	1,000	Clean outside of the oil cooler	
	2,000	Change nylon tubes	
	2,000	Change oil separator	
	3,000	Change the O-ring of the unloader	
	3,000	Check and change the unloader bushing	
	3,000	Change pressure regulator diaphragm	
	3,000	Change speed regulator diaphragm	
	3,000	Change rubber hoses	
	3,000	Check consumable parts of the auto-relief valve	
	3,000	Change consumable parts of the vacuum relief valve	
	6,000	Performance check of pressure control valve	
	6,000	Check the O-ring and piston of pressure control valve	
	12,000	Change rubber coupling	
	12,000	Change oil seal / bearing	
	12,000	Change solenoid valve	

Check		Undercarriage	Qty.
	250	Check and confirm the specified tightening torque of the nuts with which tires are fixed	
	1,000	Supply grease to trailer hub bearing	kg
	1,000	Greasing axle	kg

Comments:

OPERATION LOG

AIRMAN PDSF750S-4BS

Operation date	Operation place	Operation time		Hour meter		Daily operation hours (b)-(a)	Discharge air pressure (M/Pa)	Rated RPM (rpm/min)	Discharge air temperature (℃)	Coolant temperature (℃)	Remarks (Inspection/Parts change history etc.)
		Start time	Finish time	Start (a)	Finish (b)						
/ /		:	:								
/ /		:	:								
/ /		:	:								
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Air compressor monitoring sheet

Date:

Name:

Position:

	Monitoring	Monitoring items	Confirmation method	Evaluation		If evaluation is "No" fill in the reason
				Yes	No	
Inspection	Daily inspection	Daily inspection (DI) check sheet	Followed and checked the DI check sheet			
			After found trouble or abnormality, conducted appropriate countermeasures			
	Periodic inspection	Periodic inspection (PI) check sheet	Followed and checked the PI check sheet			
			After found trouble or abnormality, conducted appropriate countermeasures			
Operation	Before operation	Procedures	Follow the proper procedures			
	Operation	Procedures	Follow the proper operation			
	Operator	Safety protection equipment	Wearing appropriate equipment			
		Health condition	Proper behavior for works			
	Operation log	Operation log sheet	Followed and written the Operation log sheet			
	After operation	Cleaning after use the Air compressor	Cleaning condition			
		Cleaning after use the equipment	Cleaning condition			

comment:

添付資料　9

その他の活動実績

添付資料　9-1

入札関係書類

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

The Government of Democratic Socialist Republic of Sri Lanka

THE TECHNICAL COOPERATION FOR LANDSLIDE MITIGATION PROJECT

BID DOCUMENTS

FOR

THE PILOT PROJECT FOR LANDSLIDE AND ROCK FALL MITIGATION WORKS

LOT 1, LOT 2 and LOT 3

NOVEMBER 2015

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) SRI LANKA OFFICE

Table of Contents – Summary Description

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- **Section 2: Forms of Bid**
- **Section 3: Preamble to the Bill of Quantities**
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Volume II: Technical Specifications

- **Section 5: Instructions for Technical Specifications**
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- **Section 9: Specification for Horizontal drain**
- **Section 10: Specification for Gabion box**
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- **Section 12: LOT 1. Badulla Landslide mitigation works**
- **Section 13: LOT 2. Nuwara Eliya Landslide mitigation works**
- **Section 14: LOT 3. Matale Rock fall mitigation works**

INVITATION FOR BIDS

For

THE PILOT PROJECT FOR LANDSLIDE AND ROCK FALL MITIGATION WORKS

Under

THE TECHNICAL COOPERATION FOR LANDSLIDE MITIGATION PROJECT

In

The Democratic Socialist Republic of Sri Lanka

Date: 23rd November, 2015

1. Japan International Cooperation Agency(JICA) (hereinafter referred to as "the Employer") has decided to extend the Pilot project for Landslide and Rock fall mitigation works to the Government of Democratic Socialist Republic of Sri Lanka (hereinafter referred to as "the Recipient") for the construction supervision of structural mitigation measures and services necessary for the execution of the above-captioned Pilot project (hereinafter referred to as "the Project") and intends to apply the fund of the project to eligible payments under three (3) contracts for the Work related to the Project as the project for Landslide and Rock fall mitigation works (hereinafter referred to as "the Work") which includes the followings;

   Lot.1
   Horizontal drainage drilling, Gabion works and Suface drainage ditch works at Badulusirigama/ Uva Wellasa University in Badulla District, Uva Provinces. (Landslide mitigation works)

   Lot.2
   Horizontal drainage drilling, Gabion works and Suface drainage ditch works at Udamadura in Nuwara Eliya District, Central Provinces. (Landslide mitigation works)

   Lot.3
   Earth works (Excavation, Craushing rock, Embankment, Ground leveling and Stone pitching), Gabion works and Drainage works at Alagumale in Matale District, Central Provinces. (Rock fall mitigation works)

2. In order to implement the Project in an expeditious manner, Employer has sent JICA Technical cooperation team, TCLMP – JICA, the Joint Venture consisting of Earth System Science Co., LTD.as the leading firm, duly organized and existing under laws of Japan, having its principal office of business at 7F Shinjukumarune,Bldg.1-23-1, Shinjukuku, Shinjuku,Tokyo, 160-0022 Japan and Nippon Koei Co., Ltd., duly

organized and existing under laws of Japan, having its principal office of business at 5-4 Kojimachi, Chiyodaku, Tokyo, 102-8639 Japan.
TCLMP and National Building Research Organization (NBRO), an organization duly organized and existing under laws of the Democratic Socialist Republic of Sri Lanka, No. 99/1 Jawatte Road, Colombo 05, Sri Lanka, (Two Japanese firms and NBRO will hereinafter be referred to as "the Engineer") assist Employer in procuring the Work.

3. Under the Project, the JICA Sri Lanka Office (hereinafter referred to as "the Employer") invites eligible Bidders to the Bidding for the Work.

4. In this connection, you are invited to bid for the Work, and the Bidder may obtain further information from, and inspect and acquire the Bid Documents at the following offices of the Employer respectively:

Employer's Office

Sri Lanka Office, Japan International Cooperation Agency
10th & 13th Floors, DHPL Building,
No. 42, Navam Mawatha,
Colombo 02. Sri Lanka
Tel/Fax: 011-230-0470/ 011-230-0473
E-mail: shimano.toshiyuki@jica.go.jp RupasingheMegumi.SL@jica.go.jp

from 24th,25th and 26th of November 2015 from 8:30 am to 4:15 pm during working hours.

5. All Bids must be delivered to the following Employer's office at 10:00 hours for Lot 1, 13:00 hours for Lot 2 and 15:00 hours for Lot 3 on the 5th of January 2016. Bids will be opened immediately thereafter in the presence of the Bidder's representatives who are authorized with Power of Attorney of Bidder.

Sri Lanka Office, Japan International Cooperation Agency
10th & 13th Floors, DHPL Building,
No. 42, Navam Mawatha,
Colombo 02. Sri Lanka

6. The estimated date of award will be 13rd of January 2016.

VOLUME I

BIDDING PROCEDURES

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Section 1

INSTRUCTIONS TO BIDDERS

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Section 1
INSTRUCTIONS TO BIDDERS

A. GENERAL

1. Scope of Bid

1.1 Japan International Cooperation Agency(JICA) (hereinafter referred to as "the Employer") has decided to extend the Pilot project for Landslide and Rock fall mitigation works to the Government of Democratic Socialist Republic of Sri Lanka (hereinafter referred to as "the Recipient") for the construction supervision of structural mitigation measures and services necessary for the execution of the above-captioned Pilot project (hereinafter referred to as "the Project") and intends to apply the fund of the project to eligible payments under three (3) contracts for the Work related to the Project as the project for Landslide and Rock fall mitigation works (hereinafter referred to as "the Work") which includes the followings;

Lot.1
Horizontal drainage drillings, Gabion works and Surface drainage ditch works at Badulusirigama/ Uva Wellasa University in Badulla District, Uva Province (Landslide mitigation works).

or

Lot.2
Horizontal drainage drillings, Gabion works and Surface drainage ditch works at Udamadura in Nuwara Eliya District, Central Province (Landslide mitigation works).

or

Lot.3
Earth works (Excavation, Crushing rock, Embankment, Ground levelling and Stone pitching), Gabion works and Drainage works at Alagumale in Matale District, Central Province (Rock fall mitigation works).

Under the Project, the JICA Sri Lanka Office (hereinafter referred to as "the Employer") invites eligible Bidders to the Bidding for the Work.

1.2 The Employer takes overall responsibility for implementing the Work, and the consulting services for the Work shall be performed by National Building Research Organization (NBRO) and the JICA Technical cooperation team, TCLMP – JICA, the Joint Venture consisting of Earth System Science Co., LTD. and Nippon Koei Co., Ltd. who shall assist JICA in procuring the Work during the bidding stage and act as "the Engineer" in the Contract between the Employer and the Contractor during the implementation stage.

1.3 The successful Bidders will be expected to complete the Work on or before the date stipulated in Article 4 of the General Conditions of Contract.

2. Source of Funds

2.1 Employer has Technical cooperation funds for The project for Landslide and Rock fall mitigation works in Sri Lanka.

3. Eligible Bidder

3.1 Eligible Bidders shall be such firms and/or voluntarily formed consortium consisting of building/civil construction contractors and/or equipment suppliers residing in the Democratic Socialist Republic of Sri Lanka. Eligible Bidders should be those who have received notification which clearly states that the applicant satisfies the conditions of prequalification for the Work subject to the following criteria:

(a) A Bidder can participate in one or more Lots as of Clause 1.1

(b) General civil contractor or specialized Construction Contractor duly organized and registered as SP2, M4 or C5 or above grade in specialized Contractor's Registration in Civil work as of the CIDA (ICTAD) Registration.

(c) Not blacklisted by the National Procurement Agency or any other organization and any history of litigation or arbitration resulting from contracts executed in the last five (5) years or currently under execution should be declared.

(d) Experience in 1) not less than one (1) project of landslide mitigation of which contract price is not less than fifteen million Sri Kankan Rupees during the last five (5) years, 2) not less than three (3) projects of horizontal drainage drilling (using casing pipes) and/or of soil nailing (using casing pipes) during the last five (5) years, and 3) not less than one (1) project of horizontal drainage drilling and/or soil nailing of which drilling length is not less than 15 m during the last five (5) years, are necessary to apply for Lot.1 and/or Lot.2.

(e) Experience in 1) not less than three (3) projects of Civil works and/or Earth works each of which the contract price is not less than ten (10) million Sri Lankan Rupees during the past five (5) years and 2) not less than five (5) projects of earth works of Gabion works, Excavation, Crushing rock, Drainage works, Embankment and/or Stone pitching in Earth works during the past five (5) years are necessary to apply for Lot.3.

(f) Minimum in-house staff of three (3-Lot.1 and Lot.2), two (2-Lot.3) experienced and qualified Engineers.

(g) Bidders shall be capable of owning or hiring the landslide mitigation works equipment in good condition.

3.2 The company who received notification which clearly state that the applicant satisfies the conditions of prequalification for the Work is required to participate in the Pre-Bid Meeting (See Clause 17) to participate in the bid. Otherwise the company shall lose the right to participate in the bid.

4. Qualification of the Bidder

4.1 To be qualified for award of Contract, the Bidder shall:

(a) Submit a written power of attorney authorizing the signatory of the Bid to commit the Bidder; and

(b) Submit documentary evidence establishing sufficient capability to undertake the Contract. The assessment of the Bidder's proposal regarding work program, scheduling and resourcing which shall be provided in sufficient detail to confirm the Bidder's capability to complete the Work in accordance with the specification and the time for completion.

5. Limitation of Bidding

5.1 A Bidder shall be allowed to bid any or all three (3) lots.

6. Cost of Bidding

6.1 The Bidder shall bear all costs associated with the preparation and submission of its Bid and the Employer shall in no case be responsible or liable for those costs.

7. Site Visit

7.1 The Bidder is required to visit and examine the Site of the Work and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the Bid and entering into a Contract for the Work. The costs of visiting the Site shall be at the Bidder's own expense.

7.2 The Bidder and any of its personnel or agents will be granted permission by the Engineer to enter upon its premises and lands for the purpose of such inspection, but only upon the express condition that the Bidder, its personnel and agents, shall release and indemnify the Engineer and its personnel and agents from the against all liability in respect thereof and shall be responsible for death or personal injury, loss of or damage to property and any other loss, damage, costs and expenses incurred as a result of the inspection.

B. THE BID DOCUMENTS

8. Content of Bid Documents

8.1 The Bid Documents are those stated below, and should be read in conjunction with any addenda issue in accordance with Clause 10:

Invitation for Bid
Volume I: Bidding Procedures
- Section 1: Instruction to Bidders
- Section 2: Forms of Bid
- Section 3: Preamble to the Bill of Quantities
- Section 4: Forms of Contract Agreement and General Conditions of Contract

Volume II: Technical Specifications
- Section 5: Instructions for Technical Specifications

Section 6: Specification for Civil works
Section 7: Specification for Earth work
Section 8: Specification for Surface drainage ditch
Section 9: Specification for Horizontal drain
Section 10: Specification for Gabion box
Section 11: Specification for Geotextile

Volume III: Drawings
Section 12: LOT 1. Badulla Landslide mitigation works
Section 13: LOT 2. Nuwara Eliya Landslide mitigation works
Section 14: LOT 3. Matale Rock fall mitigation works

8.2 The Bidder is expected to examine carefully the contents of the Bid Documents. Failure to comply with the requirements of Bid submission will be at the Bidder's own risk. Pursuant to Clause 25, the Bid which is not substantially responsive to the requirements of the Bid Documents shall be rejected.

9. Clarification of Bid Documents

9.1 The Bidder requiring any clarification of the Bid Documents may notify the Employer in writing and such clarification shall be sent by e-mail or fax to the Employer's address indicated in the Invitation for Bid twenty five (25) days prior to the Bid closing.

9.2 The Employer shall respond in writing to the clarification stated above. The responses will be sent by e-mail or fax to all prospective Bidders who obtained the Bid Documents eighteen (18) days prior to the Bid closing.

9.3 All the prospective Bidders shall send e-mail or fax to the Employer for the confirmation of the receipt.

9.4 The responses shall constitute a part of the Bid Documents provided in Clause 8.1.

10. Amendment of Bid Documents

10.1 The Employer may, for any reason, whether at its own initiative, modify the Bid Documents by issuing addenda fourteen (14) days prior to the Bid Closing.

10.2 The prospective Bidders shall send the confirmation of receiving the addenda stated above to the Employer by e-mail or fax.

10.3 The addenda shall constitute a part of the Bid Documents provided in Clause 8.1.

C. PREPARATION OF BID

11. Language of Bid

11.1 The Bid, and all correspondence and documents, related to the Bid, exchanged between the Bidder and the Employer / the Engineer shall be written in the English language.

12. Documents

12.1 The bid submitted by the Bidder shall be referred to the Clause 19.

Comprising the Bid

13. Bid Prices

13.1 The Contract shall be for the whole Work, as described in Clause 1.1, based on the priced Bill of Quantities submitted by the bidder.

13.2 All expenses shall be included in the priced Bill of Quantities.

13.3 The Employer is to use the priced Bill of Quantities as a reference material for the following purposes such as;
(1) evaluation of the Bids,
(2) Confirmation of the adjusted contract price in case of change of work quantities during implementation of the work, and
(3) Unit price of Bill of Quantities is not changeable.

13.4 All taxes, such as VAT for the Work shall be included in the Bid and shall be eligible for the contract price for the successful Bidder.
Such taxes shall be itemized separately in the Bill of Quantities as they will be non-eligible for the contract price.

13.5 The Contract Price shall be subjected to modification during the performance of the Contract in accordance with Article 2 and 23 of the General Condition of Contract.

14. Currencies of Bid and Payment

14.1 The Bid price shall be quoted by the Bidder in Sri Lankan Rupees.

14.2 Payment of the contract price shall be made in the currency in which the bid price is expressed in the bid.

15. Bid Validity

15.1 The Bid shall remain valid for a period of 30 days after the date of deadline for submission of bid specified in Clause 20.

16. Bid Security

16.1 NOT APPLICABLE

17. Pre-Bid Meeting

17.1 The Bidder's designated representative is required to attend (a) pre-bid meeting(s) which will take place at the time and venue notified by the Engineer via e-mail or fax.
The Pre-Bid Meeting will be separately scheduled for each lot. The Bidder shall participate in the each Pre-Bid Meeting of the Lot that the Bidder intends to participate in. For example, if a Bidder intends to participate in Lot 1 and Lot 2, the Bidder shall participate in the Pre-Bid Meetings of Lot 1 and Lot 2.

17.2 The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage. The Bidder is requested, as far as possible, to submit any questions in writing or by fax to reach the Employer not later than five days (5) before the meeting. It may not be practicable at the meeting to answer questions received late.

17.3 The minutes of such pre-bid meeting shall be made available to all

Bidders within a reasonable time prior to the closing date of the Bid. Such minutes should be included by the Bidder in his Bid.

18. Format and Signing of Bid

18.1 The Bidder shall prepare one (1) original and one (1) copy of the Bid Documents comprising the Bid as described in Clause 19 of this Instruction to Bidders, bound with the volume containing the Form of Bid, and clearly marked "ORIGINAL" and "COPY" as appropriate. In the event of discrepancy between them, the original shall prevail.

18.2 The original of the Bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign on behalf of the Bidder. All pages of the Bid where entries or amendments have been made shall be initialed by the person or persons signing the Bid.

18.3 The Bid shall contain no alterations, omissions or additions, except those to comply with instructions issued by the Employer, or as necessary to correct errors made by the Bidder, in which case such corrections shall be initialed by the person or persons signing the Bid.

D. SUBMISSION OF BID

19. Sealing and Marking of Bid

19.1 The Bidder shall submit the followings;

(a) Power of attorney……..(Form-P1)

[Envelope A]
(a) Project Organization Chart (Free Form)
(b) Key Personnel……(Form-A2)
(c) Master Time Schedule for Construction……...(Form-A3)
(d) Proposed Major Construction Materials……..…(Form-A4)
(e) Proposed Construction Equipment……..(Form-A5)
(f) Safety Plan…….....…(Form-A6)
(g) Minutes of Pre-Bid meeting

[Envelope B]
(a) Forms of Bid……(Form-B1)
(b) Priced Bill of Quantities for Lot 1……(Form-B2-Lot1)
Priced Bill of Quantities for Lot 2……(Form-B2-Lot2)
Priced Bill of Quantities for Lot 3……(Form-B2-Lot3)

Envelopes shall be sealed and duly marked as "Envelope A" or "Envelope B", "ORIGINAL" or "COPY", name of the Bidder and the name of the Project and Lot number.

19.2 The envelopes shall be submitted to the Employer at the following place:

Chief Representative
Sri Lanka Office
Japan International Cooperation Agency

10th & 13th Floors, DHPL Building,
No. 42, Navam Mawatha,
Colombo 02. Sri Lanka, and

19.3 If the envelopes are not sealed, stamped and marked as above, the Employer shall assume no responsibility for the misplacement or premature opening of the Bid.

20. Deadline for Submission of Bid

20.1 The Bid must be delivered by the Bidder himself and received by the Employer at the place specified above no later than following time:

Lot 1: 10:00 hours
Lot 2: 13:00 hours
Lot 3: 15:00 hours

On the 5th of January 2016.

20.2 The Employer may, at its discretion, extend the deadline for submission of Bid by issuing an addendum in accordance with Clause 10, in which case all rights and obligations of the Employer and the Bidder previously subject to the original deadline will thereafter be subject to the deadline as extended.

21. Late Bid

21.1 Any Bid received by the Employer after the deadline for submission of Bids prescribed in Clause 20 will be rejected and returned unopened to the Bidder.

22. Modification and Withdrawal of Bid

22.1 No Bid shall be modified by the Bidder after the submission of Bid.

E. BID OPENING AND EVALUATION

23. Bid Opening

23.1 The Employer will open the Bid in the presence of Bidder's representative who are authorized with Power of Attorney of Bidder.

23.2 The presence or absence of the Bid Prices, any discounts and such other details as the Employer may consider appropriate shall be recorded by the Employer at the Bid opening under the presence of the Bidder's representative. The Bidder's representative shall be required to sign the record.

23.3 All Bids shall be opened on the date, time and place specified in the Invitation for Bids, immediately after the closing time, in the presence of the Employer, the Engineer and the Bidders.

At least one (1) authorized person with Power of Attorney of Bidder who submitted the Bid Documents shall attend the Bid opening.

23.4 Bid Opening Procedure

(1) All participants in the Bid opening shall register their signatures in an attendant list prepared by the Employer before the Bid opening.

(2) The Employer shall confirm each “Power of Attorney” of the Bidders. In case the document is incomplete or inappropriate, the Bidder shall forfeit his right to participate in the Bid opening any further and the Bid shall be returned unopened.

(3) Envelope-A will be opened and availability of the documents in Envelope-A required in 19.1 shall be examined. In case the document is incomplete or inappropriate, the Bidder shall forfeit his right to participate in the Bid opening any further and Envelope-B shall be returned unopened. The appropriateness of each document shall be examined carefully and thoroughly afterwards in the stage of Bid evaluation.

(4) Envelope-B will be opened and the Bid price offered by each Bidder shall be read aloud and recorded. The Bidder who submits the lowest Bid price within the ceiling price set forth by the Employer shall be designated as the prioritized negotiator for the contract. In the event that the prioritized negotiator is rejected as a result of the evaluation of the Bid, the Employer will invite the next lowest Bidder to enter into negotiation for the contract. This procedure will be followed until the Employer reaches agreement with a Bidder.

(5) In the event that all Bid prices offered exceed the ceiling price, the Bidders are requested to submit the prices again immediately after the first Bid opening. In this case, Bidders shall be requested to submit the Form of Bid only. The Form of Bid will be prepared by the Employer and distributed to each Bidder before the second Bid. The representative of each Bidder who attends the Bid opening shall, therefore, be duly authorized by his firm or company to submit the Bids for these second offers.

(6) In the second bidding, the Bidder who submits the lowest Bid price within the ceiling price set forth by the Employer shall be designated as the prioritized negotiator for the contract. In the event that the prioritized negotiator is rejected as a result of the evaluation of the Bid, the Employer will invite the next lowest Bidder to enter into negotiation for the contract. This procedure will be followed until the Employer reaches agreement with a Bidder.

(7) If the Bid prices in the second bidding exceed the ceiling price, the same procedure of (5) and (6) stated above shall be repeated for the third bidding.

(8) If the Bid prices in the third bidding exceed the ceiling price, the Bidder submitting the lowest price on the third bidding will be asked to enter into price negotiation in the stage of the bid evaluation for price reduction to the ceiling price. When negotiation with the Bidder submitting the lowest price on the third bidding is not successful, the Bidder submitting second lowest price will be asked to enter into price negosiation.

(9) In case there are two or more Bids at the same price within the ceiling price, a prioritized Bid shall be determined by drawing lots.

24. Process to be Confidential

24.1 Information relating to the examination, clarification and evaluation of the Bid and recommendations for the award of a contract shall not be disclosed to the Bidder or any other persons not officially concerned with such process until the award to the Bidder has been announced. Any effort by the Bidder to influence the Employer's processing of Bid or award decisions may result in the rejection of the Bidder's Bid.

25. Clarification of Bid

25.1 To assist in the examination and evaluation of Bids, the Employer may, at its discretion, ask the Bidder for clarification of its Bid, including breakdowns of unit rates. The request for clarification and the response shall be in writing or by fax, but no change in the price or substance of the Bid shall be sought, offered or permitted except as required to confirm to correction of arithmetic errors discovered by the Employer in the evaluation of the Bids in accordance with Clause 27.

26. Examination of Bid Responsive-ness

26.1 The Employer will determine whether the Bid

(i) meets the eligibility criteria
(ii) has been properly signed;
(iii) is substantially responsive to the requirements of the Bid Documents; and
(iv) Provides any clarification and/or substantiation that the Employer may require pursuant to Clause 26.

26.2 The Employer will carefully review the Bid to determine that it technically confirms the following major items derived from the submitted technical documents by the Form of Supplemental Information;

(a) Project Organization
(b) Key Personnel
(c) Master Time Schedule for Construction
(d) Proposed Major Construction Materials
(e) Proposed Construction Equipment
(f) Safety Plan
(g) Minutes of Pre-Bid meeting

26.3 A substantially responsive Bid is one which conforms all the terms, conditions and specifications of the Bid Documents, without material deviation or reservation. A material deviation or reservation is one (i) which affects in any substantial way the scope, quality or performance of the Work; (ii) which limits in any substantial way, inconsistent with the Bid Documents, the Employer's rights or the Bidder's obligations under the Contract; or (iii) whose rectification would affect unfairly the conditions of and substantial responsiveness to the Bid.

26.4 If a Bid is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.

27. Correction of Errors

27.1 The Bid determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Arithmetic errors will be rectified on the following basis. If there is a discrepancy between the unit rate and the total cost per item that is obtained by multiplying the unit rate and quantity, the unit rate shall prevail and the total cost per item will be corrected unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit rate, in which case the total cost per item as quoted will govern and the unit rate corrected. If there is a discrepancy between the total Bid amount and the sum of total costs per item, the total Bid amount shall prevail and the sum of the total costs per item shall be corrected.

27.2 The amount stated in the Form of Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and, shall be considered as bin
ding upon the Bidder. If the Bidder does not accept the corrected amount of Bid, its Bid will be rejected.

28. Evaluation of Bid

28.1 In evaluating the Bid, the Employer will determine the Evaluated Bid Price by adjusting the Bid Price as follows:

(a) making any correction for errors pursuant to Clause 27;

28.2 The Employer reserves the right to accept or reject any variation, deviation or alternative offer. Variations, deviations, alternative offers and other factors which are in excess of the requirements of the Bid Documents or otherwise result in the accrual of unsolicited benefits to the Employer shall not be taken into account in bid evaluation.

28.3 The evaluation of Bids shall take into account the price and other commercial features of the offer.

28.4 The estimated effect of the price adjustment provisions of the General Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in Bid evaluation.

28.5 If the Bid is seriously unbalanced in relation to or substantially below the Employer's estimate of the cost of work to be performed under to Contract, the Employer may require the Bidder to produce detailed price analyses for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require that the amount of the performance security set forth in Article 12 of the General Conditions of Contract be increased at the expense of the Bidder to

a level sufficient to protect the Employer against financial loss in the event of default of the Bidder under the Contract.

F. AWARD OF CONTRACT

29. Award

29.1 Subject to Clause 31, the Employer will award the Contract to the Bidder provided that the Bidder has been determined to be eligible in accordance with the provisions of Clause 3.1 and 4.1.

30. Employer's Right to Accept or Reject the Bid

30.1 Notwithstanding Clauses 31, the Employer reserves the right to accept or reject the Bid, and to annul the Bidding process and reject the Bid at any time prior to award of Contract, without thereby incurring any liability to the Bidder or any obligation to inform the Bidder of the grounds for the Employer's action.

31. Notification of Award

31.1 Prior to expiration of the period of Bid validity of thirty (30) days as described in the Clause 15, the Employer will notify the Bidder by registered letter that its Bid has been accepted. This letter (hereinafter and in the General Conditions of Contract called the "Letter of Acceptance") shall name the sum which the Employer will pay the Contractor in consideration of the execution, completion and maintenance of the Work by the Contractor as prescribed by the Contract (hereinafter and in the General Conditions of Contract called "the Contract Price").

31.2 The notification of award will constitute the form of Contract agreement

31.3 The Employer will promptly notify the other Bidders that their Bids have been unsuccessful.

32. Signing of Agreement

32.1 Subject to Clause 31, the Employer will enter into signing Form of Contract Agreement provided in the Bid Documents, incorporating all agreements with the Bidder whose Bid has been determined to be substantially responsive to the Bid Documents and who has offered acceptable evaluated bid price. At the same time, the Bidder shall sign the Form of Contract Agreement.

33. Common Conditions

33.1 Safety Procedure

The Contractor shall:

(1) comply with all applicable safety regulations,

(2) prepare safety plan and method statements on safety plan in line with "The Guidance for the Management of Safety for Construction Works in Japanese ODA Projects"

URL:
http://www.jica.go.jp/activities/schemes/oda_safety/ku57pq00001nz4eu-att/guidance_en.pdf

(3) take care for the safety of all persons entitled to be on the Site,

(4) use reasonable efforts to keep the Site and the Work clear of unnecessary obstruction so as to avoid danger to these persons,

(5) provide fencing, lighting, guarding and watching of the Work until completion and taking-over, and

(6) Provide any temporary works (including roadways, footways, guard and fences) which may be necessary, because of the execution of the Work, for the use and protection of the public and of owners and occupiers of adjacent land.

33.2 Quality Assurance

(1) The Contractor shall institute a quality assurance system to demonstrate compliance with the requirements of the Contract. The system shall be in accordance with the details stated in the Contract.

(2) Compliance with the quality assurance system shall not relieve the Contractor of any of his duties, obligations or responsibilities under the Contract.

33.3 Protection of the Environment

The Contractor shall take all reasonable steps to protect the environment (both on and off Site) and to limit damage and nuisance to people and property resulting from pollution, noise and other result of his operations.

Section 2

FORMS OF BID

The Bidder shall complete and submit the Form of Bid and Appendix to Bid all in accordance with the requirements of the bidding documents.

TABLE OF FORMS

Form P1: POWER OF ATTORNEY 2-1
Form A2: KEY PERSONNEL 2-2
Form A3: MASTER TIME SCHEDULE FOR CONSTRUCTION 2-3
Form A4: PROPOSED MAJOR CONSTRUCTION MATERIALS 2-4
Form A5: PROPOSED CONSTRUCTION EQUIPMENT 2-5
Form A6: SAFETY PLAN 2-6

Form B1: Form OF Bid 2-7
Form B2-Lot1: Bill of Quantities fot Badulla Landslide mitigation works 2-9
Form B2-Lot2: Bill of Quantities fot Muwara Eliya Landslide mitigation works 2-12
Form B2-Lot3: Bill of Quantities fot Matale Rock fall mitigation works 2-15

(Form P1)

**1 fill in the number of Lot*

LOT **1*

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS, that (Name of Bidder) , a corporation duly organized and existing under the laws of Sri Lanka, with its principal place of business at (Address of Bidder), dose hereby constitute, designate and appoint (Name and designation of Representative of the Bidder), whose specimen signature is shown below, as our true and lawful attorney-in-fact, in our name, place and stead, with full powers of substitution and revocation, to sign and submit the bid documents and all documents related to the Bidder for the Pilot project for Landslide and Rock fall mitigation works, and to do any and all acts and deeds as the said attorney-in-fact may deem requisite, necessary or proper to be done in connection therewith, all in our name and on our behalf, hereby ratifying and confirming all that the said attorney-in-fact shall do pursuant to the power hereunder granted.

This Power of Attorney has been drawn up in the city of_____, Sri Lanka on this (day)th day of (month), 2015 and shall remain in full force and effect until our further notice.

NAME OF BIDDER

(Signature)_____

(Name in Print)_____

(Title)_____

(Specimen Signature of the Representative)

(Verification of signature by the relevant Authority)

(Form A2)

**1 fill in the number of Lot*

LOT **1*

KEY PERSONNEL

	Name of Nominee	Summary of Qualifications Experience and Present Occupation
Site Office Key Staff		

Notes:

1. The bidder shall list in this form the key personnel who will employ from Site Office to direct and execute the Work. The bidder shall attach CV's of each Site Office Key staff above describing their education, technical qualifications, work experience with its assignment and positions, language capability held and their nationalities.
2. The form shall be entered into the Contract for information purposes only. Its inclusion shall not relieve the Contractor of his General Obligations under the Contract.

(Form A3)

**1 fill in the number of Lot*

LOT **1*

MASTER TIME SCHEDULE FOR CONSTRUCTION

The Bidder shall submit a comprehensive Master Time Schedule indicating all major work activities for execution of the work in their sequence order and expected duration, sequence and relation of all major operation or construction activities. The Master Time Schedule shall clearly show but not limited to the following views and work activities and shall be supported by a time schedule for manpower utilization and other relevant data or statements, etc.

1) Mobilization and Demobilization Schedule
2) Procurement and Delivery of Major Construction Materials
3) Sequence and Duration of Major Works
4) Identification of Works executed by Subcontractor(s)
5) Critical Operations or Activities of Construction
6) Time of Completion for the Whole Works

The Schedule shall be prepared in the form of arrow diagram.

(Form A4)

**1 fill in the number of Lot*

LOT **1*

PROPOSED MAJOR CONSTRUCTION MATERIALS

Description (Type, Name)	Class or Size of Product	Name of Manufacture	Code or Specifications

NOTES:

1. The bidder shall enter in this form all items of materials and equipment for their identification which are proposed to use and incorporate as the Work under the contract.
2. The inclusion of this form into the Contract for identification of materials and equipment to be procured for the Work shall not relieve the Contractor of his General Obligation under the Contract.

(Form A5)

**1 fill in the number of Lot*

LOT **1*

PROPOSED CONSTRUCTION EQUIPMENT

1. Mobilization

Description (Type, Model, Make)[1]	No. of Each	Year of Manufacture	New or Used	Owned (O) or Leased (L)	Rating	Power t or m^3	Capacity
1.1							
1.2							
1.3							
1.4							
1.5							

2. Demobilization

Description (Type, Model, Make)[1]	No. of Each	Year of Manufacture	New or Used	Owned (O) or Leased (L)	Rating	Power t or m^3	Capacity
2.1							
2.2							
2.3							
2.4							
2.5							

NOTES:

1. The bidder shall enter in the information 1 & 2 above all items of construction equipment owned, leased (rented) and proposed to buy, which he proposes to bring on Site and which formed the basis of the Mobilization/Demobilization Lump Sum Items.
2. The inclusion of this form into the Contract for certification of the Mobilization/Demobilization Lump Sum shall not relieve the Contractor of his General Obligations under the Contract.

(Form A6)

**1 fill in the number of Lot*

LOT **1*

SAFETY PLAN

COMPOSITION OF THE SAFETY PLAN

1. Items for inclusion in the Safety Plan

A typical Safety Plan shall be comprised of the followings:

(1) Basic Policies for Safety Management
(2) Internal Organizational Structure for Safety Management
(3) Promotion of the PDCA Cycle
(4) Monitoring
(5) Safety Education and Training
(6) Voluntary Safety Management Activities
(7) Sharing Information
(8) Response to Emergencies and Unforeseen Circumstances

2. Compliance with items for inclusion

Since items that constitute the Safety Plan as described in " Items for inclusion in the Safety Plan (1)-(8)" apply generally to all ODA Projects, the Contractor shall incorporate all those items into their Safety Plan.

Items other than those specified in "Items for inclusion in the Safety Plan" which arise with respect to the scope of work or the conditions for construction, shall also be specified in the Safety Plan.

NOTES:

The Bidder shall read through " The Guidance for the Management of Safety for Construction Works in Japanese ODA Projects"

http://www.jica.go.jp/activities/schemes/oda_safety/ku57pq00001nz4eu-att/guidance_en.pdf

(Form B1)

**1 fill in the number of Lot*

LOT **1*

Form of Bid

The Pilot project for Landslide and Rock fall mitigation works

LOT 1, LOT 2 or LOT 3

for

The Technical Cooperation for Landslide Mitigation Project

Mr. Kiyoshi AMADA
Chief Representative,
Sri Lanka Office,
Japan International Cooperation Agency,
10th & 13th Floors, DHPL Building,
No. 42, Navam Mawatha,
Colombo 02. Sri Lanka

Gentlemen:

1. Having examined the Conditions of Contract, Specification, Drawings, and Bill of Quantities and Addenda Nos. …….. for the execution of the above-named Works, we, the undersigned, offer to execute and complete such Works and remedy any defects therein in conformity with the Conditions of Contract, Specification, Drawings, Bill of Quantities and Addenda for the sum of Sri Lankan Rupees ……..…… (excluding the VAT) as specified in the Appendix to Bid or such other sums as may be ascertained in accordance with the said Conditions.

2. We undertake, if our Bid is accepted, to commence the Work as soon as is reasonably possible after the receipt of the Employer's notice to commence, and to complete the whole of the Work comprised in the Contract within the time stated in the General Conditions of Contract.

3. We agree to abide by this Bid for the period of 30 days from the date fixed for receiving the same, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

4. Unless and until a formal Agreement is prepared and executed this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.
5. We understand that you are not bound to accept the lowest or any bid you may receive.

Date this…….day of……..2015……..in the capacity of……..duly authorized

to sign bids for and on behalf of ……..…….

[in block capitals or typed]

Signature:
…….

Name:
……

Address:
.....

Witness:
……

Address:
.....

Occupation:
……

(Form B2-Lot 1)

BILL OF QUANTITIES fot Badulla Landslide mitigation works

Japan International Cooperation Agency (JICA) Sri Lanka Office,
10th & 13th Floors, DHPL Building,
No. 42, Navam Mawatha,
Colombo 02. Sri Lanka

Item	Description	Unit	Qty	Rste	AMOUNT
1	**CONTRACTOR'S SITE ESTABLISHMENT**				
1.1	Establishment, maintenance, and removal of contractor's site facilities such as office, stores, services, security, etc…	LS	1		
1.2	Mobilization and de-mobilization of plant, equipment, and machinery	LS	1		
TOTAL OF CONTRACTOR'S SITE ESTABLISHMENT				**A**	
2	**HEALTH, SAFETY AND ENVIRONMENT**				
2.1	Health and safety measures during construction confirming to the latest industrial standards	LS	1		
2.2	Environmental protection and precaution during construction (hording and dust screens shall be provided to control dust escaping to surrounding areas).	LS	1		
TOTAL OF HEALTH, SAFETY AND ENVIRONMENT				**B**	
3	**INSURANCE, BONDS AND SECURITIES**				
3.1	Insurance of works, contractor's equipment, third party, and workmen's compensation	LS	1		
3.2	Performance security	LS	1		
3.3	Advance payment security	LS	1		
TOTAL OF INSURANCE, BONDS AND SECURITIES				**C**	
4	**PROJECT SIGN BOARDS**				
4.1	Provide and maintain project signboards	item	1		
TOTAL OF PROJECT SIGN BOARDS				**D**	
5	**SITE INVESTIGATION / TESTING**				
5.1	Site investigation and Testing as directed by the Engineer (Not included in contractors quality control/assurance plane)	PS	1		
TOTAL OF SITE INVESTIGATION / TESTING				**E**	
6	**QUALITY STANDARD AND PROGRESS**				
6.1	Provision for monthly progress reports and photograps and etc	Month	16		
6.2	Provide as built drawings, Quality assurance reports	LS	1		
TOTAL OF QUALITY STANDARD AND PROGRESS				**F**	

7	**HORIZONTAL DRAINAGE DRILLING**				
7.1	Temporary working platform for Horizontal Drilling Work.	m³	24		
7.2	Drilling for 100mm dia horizontal drains through any type of soil an intermittent rock and disposal of drilled material away from site as directed by Engineer.	m	2,400		
7.3	Ditto - do - but through fresh bedrock.	m	255		
7.4	90mm dia long drains with perforated type 1000 PVC pipes and geotextile wrapping. Rate shall include for any other associated work as directed by the Engineer.	m	2,655		
7.5	Supplying and placing of 90mm dia Polyethylene pipes Type 1000. Rate shall include for connecting the pipes to the PVC pipes and any other associated work as directed by the Engineer.	m	127		
TOTAL OF HORIZONTAL DRAINAGE DRILLING				**G**	
8	**GABION WORK.**				
8.1	Supplying, assembling and placing of PVC coated Gabion wall boxes of size 1.0 x 1.0 x 1.0m, filling dry rubble 6" x 9" at toe region of the surface drain outlet including provision of excavation & trimming and preparation of ground surface to accommodate the proper placing of gabion boxes and as per the specifications, drawings and instructed by the Engineer.	m³	60		
TOTAL OF GABION WORK				**H**	
9	**SURFACE DRAINAGE DITCH**				
	Construction of RCC drains including Excavation for structures in soil, backfilling with existing soil, and disposal of excess materials away from the site within 5km distance as directed by the Engineer, planking and strutting if necessary, Supply and laying Grade 15 concrete and Grade 25 concrete prepared at site using mixer and vibrator, Tor steel reinforcement, Supply and fabricate, installing removing of formwork (ply wood) to sides of Drain Expansion joints with water stops for drain @20m intervals and cost of curing continuously. Specification: SCA 05-302 SCA/5/1001 SCA/5/1002 SCA/5/1008 Parti.Spec. Pay: SCA 05-302(1) SCA/5/1001(2) SCA/5/1002(1) SCA/5/1008(1)Parti.Preamble				
9.1	B300 H300	m	380		
9.2	B450 H450	m	225		
9.3	B600 H500	m	69		
9.4	B600 H600	m	103		
9.5	B600 H900	m	84		
TOTAL OF SURFACE DRAINAGE DITCH				**I**	

10	**WATER COLLECTING PIT**				
	Construction of RCC drains including Excavation for structures in soil, backfilling with existing soil, and disposal of excess materials away from the site within 5km distance as directed by the Engineer, planking and strutting if necessary, Supply and laying Grade 15 concrete and Grade 25 concrete prepared at site using mixer and vibrator, Tor steel reinforcement, Supply and fabricate, installing removing of formwork (ply wood) to sides of walls and siffits and cost of curing continuously. Specification: SCA 05-302, SCA/5/1001, SCA/5/1002, SCA/5/1008 Pay: SCA 05-302(1), SCA/5/1001(2), SCA/5/1002(1), SCA/5/1008(1)				
10.1	0.6 x 0.6 x 0.5m	nos.	1		
10.2	1.5 x 1.5 x 0.8m	nos.	2		
10.3	1.7 x 1.7 x 1.1m	nos.	1		
TOTAL OF WATER COLLECTING PIT				**J**	

1. Lot 1: TOTAL OF BILL OF QUANTITIES (TOTAL OF A～J)	
2. Contingencies-10% of Sub Total	
TOTAL BID PRICE (1+2)	
TOTAL BID PRICE (Amount in words):	
VAT 12% OF TOTAL BID PRICE	
GRAND TOTAL INCLUDING VAT	

(Signature)

(Name of Signer)

(Title of Signer)

(Form B2-Lot 2)

Lot 2: BILL OF QUANTITIES fot Nuwara Eliya Landslide mitigation works

Japan International Cooperation Agency (JICA) Sri Lanka Office,
10th & 13th Floors, DHPL Building,
No. 42, Navam Mawatha,
Colombo 02. Sri Lanka

Item	Description	Unit	Qty	Rate	Amount
1	**CONTRACTOR'S SITE ESTABLISHMENT**				
1.1	Establishment, maintenance, and removal of contractor's site facilities such as office, stores, services, security, etc…	LS	1		
1.2	Mobilisation and de-mobilization of plant, equipment, and machinery	LS	1		
	TOTAL OF CONTRACTOR'S SITE ESTABLISHMENT			**A**	
2	**HEALTH, SAFETY AND ENVIRONMENT**				
2.1	Health and safety measures during construction confirming to the latest industrial standards	LS	1		
2.2	Environmental protection and precaution during construction (hording and dust screens shall be provided to control dust escaping to surrounding areas).	LS	1		
	TOTAL OF HEALTH, SAFETY AND ENVIRONMENT			**B**	
3	**INSURANCE, BONDS AND SECURITIES**				
3.1	Insurance of works, contractor's equipment, third party, and workmen's compensation	LS	1		
3.2	Performance security	LS	1		
3.3	Advance payment security	LS	1		
	TOTAL OF INSURANCE, BONDS AND SECURITIES			**C**	
4	**PROJECT SIGN BOARDS**				
4.1	Provide and maintain project signboards	item	1		
	TOTAL OF PROJECT SIGN BOARDS			**D**	
5	**SITE INVESTIGATION / TESTING**				
5.1	Site investigation and Testing as directed by the Engineer (Not included in contractors quality control/assurance plane)	PS	1		
	TOTAL OF SITE INVESTIGATION / TESTING			**E**	
6	**QUALITY STANDARD AND PROGRESS**				
6.1	Provision for monthly progress reports and photographs and etc	Month	9		
6.2	Provide as built drawings, Quality assurance reports	LS	1		
	TOTAL OF QUALITY STANDARD AND PROGRESS			**F**	
7	**HORIZONTAL DRAINAGE DRILLING**				
7.1	Temporary working platform for Horizontal Drilling Work.	m^3	11		
7.2	Drilling for 100mm dia horizontal drains through any type of soil an intermittent rock and disposal of drilled material away	m	450		

	from site as directed by Engineer.				
7.3	Ditto - do - but through fresh bedrock.	m	50		
7.4	90mm dia long drains with perforated type 1000 PVC pipes and geotextile wrapping. Rate shall include for any other associated work as directed by the Engineer.	m	500		
7.5	Supplying and placing of 90mm dia Polyethylene pipes Type 1000. Rate shall include for connecting the pipes to the PVC pipes and any other associated work as directed by the Engineer.	m	25		
	TOTAL OF HORIZONTAL DRAINAGE DRILLING			**G**	
8	**GABION WORK.**				
8.1	Supplying, assembling and placing of PVC coated Gabion wall boxes of size 1.0 x 1.0 x 1.0m, filling dry rubble 6" x 9" at toe region of the surface drain outlet including provision of excavation & trimming and preparation of ground surface to accommodate the proper placing of gabion boxes and as per the specifications, drawings and instructed by the Engineer.	m^3	10		
	TOTAL OF GABION WORK			**H**	
9	**SURFACE DRAINAGE DITCH**				
	Construction of RCC drains including Excavation for structures in soil, backfilling with existing soil, and disposal of excess materials away from the site within 5km distance as directed by the Engineer, planking and strutting if necessary, Supply and laying Grade 15 concrete and Grade 25 concrete prepared at site using mixer and vibrator, Tor steel reinforcement, Supply and fabricate, installing removing of formwork (ply wood) to sides of Drain Expansion joints with water stops for drain @20m intervals and cost of curing continuously. Specification: SCA 05-302, SCA/5/1001, SCA/5/1002, SCA/5/1008, Parti.Spec. Pay: SCA 05-302(1), SCA/5/1001(2), SCA/5/1002(1), SCA/5/1008(1), Parti.Preamble				
9.1	B450 H450	m	149		
9.2	B600 H500	m	230		
9.3	B600 H700	m	106		
	TOTAL OF SURFACE DRAINAGE DITCH			**I**	
10	**WATER COLLECTING PIT**				
	Construction of RCC drains including Excavation for structures in soil, backfilling with existing soil, and disposal of excess materials away from the site within 5km distance as directed by the Engineer, planking and strutting if necessary, Supply and laying Grade 15 concrete and Grade 25 concrete prepared at site using mixer and vibrator, Tor steel reinforcement, Supply and fabricate, installing removing of formwork (ply wood) to sides of walls and siffits and cost of curing continuously.				

	Specification: SCA 05-302, SCA/5/1001, SCA/5/1002, SCA/5/1008 Pay: SCA 05-302(1), SCA/5/1001(2), SCA/5/1002(1), SCA/5/1008(1)				
10.1	1.1×1.1×0.7m	nos.	1		
10.2	1.6×1.6×0.9m	nos	2		
	TOTAL OF WATER COLLECTING PIT			**J**	
11	**SMALL DAM**				
11.1	Supplying, assembling and placing of PVC coated Gabion wall boxes of size 1.0 x 1.0 x 1.0m, filling dry rubble 6" x 9" at toe region of the surface drain outlet including provision of excavation & trimming and preparation of ground surface to accommodate the proper placing of gabion boxes and as per the specifications, drawings and instructed by the Engineer. Gabion H=2.0m Specification: SCA/5/1001 Pay: SCA/5/1001(2)	nos	1		
11.2	Supplying, assembling and placing of PVC coated Gabion wall boxes of size 1.0 x 1.0 x 1.0m, filling dry rubble 6" x 9" at toe region of the surface drain outlet including provision of excavation & trimming and preparation of ground surface to accommodate the proper placing of gabion boxes and as per the specifications, drawings and instructed by the Engineer. Concrete H=1.0m Specification: SCA/5/1001 Pay: SCA/5/1001(2)	nos	1		
	TOTAL OF SMALL DAM			**K**	
1. Lot 2: TOTAL OF BILL OF QUANTITIES (TOTAL OF A～K)					
2. Contingencies-10% of Sub Total					
TOTAL BID PRICE (1+2)					
TOTAL BID PRICE (Amount in words):					
VAT 12% OF TOTAL BID PRICE					
GRAND TOTAL INCLUDING VAT					

(Signature)

(Name of Signer)

(Title of Signer)

(Form B2-Lot 3)

Lot 3: BILL OF QUANTITIES fot Matale Rock fall mitigation works

Japan International Cooperation Agency (JICA) Sri Lanka Office,
10th & 13th Floors, DHPL Building,
No. 42, Navam Mawatha,
Colombo 02. Sri Lanka

Item	Description	Unit	Qty	Rate	Amount
1	**CONTRACTOR'S SITE ESTABLISHMENT**				
1.1	Establishment, maintenance, and removal of contractor's site facilities such as office, stores, services, security, etc…	LS	1		
1.2	Mobilisation and de-mobilization of plant, equipment, and machinery	LS	1		
	TOTAL OF CONTRACTOR'S SITE ESTABLISHMENT			**A**	
2	**HEALTH, SAFETY AND ENVIRONMENT**				
2.1	Health and safety measures during construction confirming to the latest industrial standards	LS	1		
2.2	Environmental protection and precaution during construction (hording and dust screens shall be provided to control dust escaping to surrounding areas).	LS	1		
	TOTAL OF HEALTH, SAFETY AND ENVIRONMENT			**B**	
3	**INSURANCE, BONDS AND SECURITIES**				
3.1	Insurance of works, contractor's equipment, third party, and workmen's compensation	LS	1		
3.2	Performance security	LS	1		
3.3	Advance payment security	LS	1		
	TOTAL OF INSURANCE, BONDS AND SECURITIES			**C**	
4	**PROJECT SIGN BOARDS**				
4.1	Provide and maintain project signboards	item	1		
	TOTAL OF PROJECT SIGN BOARDS			**D**	
5	**SITE INVESTIGATION / TESTING**				
5.1	Site investigation and Testing as directed by the Engineer (Not included in contractors quality control/assurance plane)	PS	1		
	TOTAL OF SITE INVESTIGATION / TESTING			**E**	
6	**QUALITY STANDARD AND PROGRESS**				
6.1	Provision for monthly progress reports and photograps and etc	Month	11		
6.2	Provide as built drawings, Quality assurance reports	LS	1		
	TOTAL OF QUALITY STANDARD AND PROGRESS			**F**	
7	**EARTH WORK**				
7.1	Excavation for canal (ditch) in soil soft rock, disposal of materials on site location and presevating for reuse as directed by the Engineer.	m^3	1,030		
7.2	Rock excavation for structures/reshaping the slope/berms using **control blasting** and disposal of excess materials away	m^3	412		

	from the site within 5km distance as directed by the Engineer.				
7.3	Rock excavation for rock **using mechanical** (using excavator or breaker) and disposal of materials on site location and presevating for reuse as directed by the Engineer. Specification:SCA/5/302 Pay: SCA 05-302(3&4)	m^3	1		
7.4	Rock excavation for rock **using mechanical** (using excavator or breaker) and disposal of materials on site location and presevating for reuse as directed by the Engineer.	m^3	1		
7.5	Filling to Embankment using exsisting soil at downside of the slope including compaction (Ave. effective height-2m approximate) as per the specifications, drawing and instructed by the Engineer.	m^3	738		
7.6	Leveling of excavated Canal disposal of materials on site location and presevating for reuse as directed by the Engineer.	m^3	91		
7.7	Suppying and placing of Rubble stone pitching top of the Earth embankment and bottom of the Canal as directed by the Engineer.	m^2	679		
	TOTAL OF EARTH WORK			**G**	
8	**GABION WORK.**				
8.1	Supplying, assembling and placing of PVC coated Gabion wall boxes of size 1.0 x 1.0 x 1.0m, filling dry rubble 6" x 9" at toe region of the surface drain outlet including provision of excavation & trimming and preparation of ground surafce to accomodate the proper placing of gabion boxes and as per the specifications, drawings and instructed by the Engineer.	m^3	201		
	TOTAL OF GABION WORK			**H**	
9	**DRAINAGE WORK**				
9.1	Supplying and placing of 700mmØ Precast RCC hume Pipee. Rate to include for Excavation for drian, Connection of Pipes and Backfill as per the drawings, specifications and as instructed by the Engineer.	m	18		
	TOTAL OF DRAINAGE WORK			**I**	
1. Lot 3: TOTAL OF BILL OF QUANTITIES (TOTAL OF A～I)					
2. Contingencies-10% of Sub Total					
TOTAL BID PRICE (1+2)					
TOTAL BID PRICE (Amount in words):					
VAT 12% OF TOTAL BID PRICE					
GRAND TOTAL INCLUDING VAT					

(Signature)

(Name of Signer)

(Title of Signer)

Section 3

PREAMBLE TO THE BILL OF QUANTITIES

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Preamble to the Bill of Quantities

A. General

1.1 The Bill of Quantities shall be read in conjunction with all parts of this entire Bidding Document; the Instructions to Bidders, General Conditions of Contract, Technical Specifications, Drawings, and supplementary information.

1.2 The Bill of Quantities includes lump items, unit price items and provisional sum items.The lump sum price quoted will be deemed to be full compensation for completion o fwork items and paid in full when the work is completed. The quantities given in the Bill of Quantities for the unit price items are estimated and provisional, and are given to provide a common basis for bidding. They are not intended to be the maximum or minimum quantities for payment. The unit prices will be considered full compensation for those work items. The basis of payment will be the actual quantities of work carried out under the provisions of the Contract, measured and valued at the applicable rates and prices in the priced Bill of Quantities.

1.3 The rates and prices bid in the priced Bill of Quantities shall, except as otherwise provided under the Contract, include all construction plant, equipment, labour, supervision, materials, transport, erection, maintenance, testing, insurance, overheads, taxes, and duties, together with all general risks, liabilities, and obligations set out or implied in the Contract.

1.4 A rate or price shall be entered against each item in the priced Bill of Quantities, whether quantities are stated or not. The cost of items against which the Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.

1.5 The rates and prices entered in the Bill of Quantities shall be full compensation for completed work and shall have taken full account of all requirements and obligations, covered by all parts of the contract, including but not limited to, the following,unless expressly stated otherwise:

a. All setting out and survey works including Pre and Post Construction Surveys.
b. All additional site surveys and investigations, preparation of field amendment drawings, shop drawings and As-Built drawings.
c. Mobilization and Demobilization of labour, all construction plant and equipment.
d. Establishment, Maintenance and Removal of all temporary facilities (Contractor's and Engineer's) including offices, workshops, houses, labour camps construction

and storage yards, Laboratory facilities and Equipment, Transport for staff and labour etc.

e. Labour and all costs in connection therewith, including but not limited to social charges or fringe benefits.
f. The supply of material and goods, storage and costs in connection therewith including delivery to site and handling material within the site/sites.
g. Taking delivery of materials and goods supplied by others, unloading, storage, handling materials within site, and costs in connection therewith.
h. Construction Plant & Equipment and all costs in connection therewith.
i. Fixing, erecting and installing or placing of materials and goods in position, including usual auxiliary material etc.
j. Temporary Works.
k. Complying with any limitations and constraints on the use of the site/sites including coordinating with other Contractor's, with regard to site access, security etc., maintenance of access to households and other users, maintenance of existing roads, waterways etc.
l. Dealing with the existing flow of water from any source including rainfall and surface runoff, groundwater, wave action and the like. This includes all and any dewatering operations necessary for the execution of the Work.
m. General obligations, liabilities and risks involved in the execution of the Work set forth or reasonably implied in the documents on which the Bid is based.
n. Overheads and profit.
o. Waste of material.
p. Attendance and transport for surveys, survey instruments, sampling and testing carried out by the Engineer.
q. Performing all sampling and testing which are required to be carried out by the Contractor, and supplying results of such tests.
r. Providing required material delivery certificates.
s. Coordination with Regulatory Institutes & all stake holders.
t. Disposal of all waste material.
u. Complying with all requirements in Specifications and Conditions of Contract where separate items have not been provided.

1.6 Where Bill of Quantities items describe the replacement of existing equipment or components, including mechanical and electrical equipment, the equipment

removed remains the property of the Employer, unless stated otherwise in the contract documents. The rates entered shall include for delivery of such equipment to the Employer or for disposal if so directed by the Employer.

1.7 The whole cost of complying with the provisions of the Contract (excluding VAT) shall be included in the Items provided in the priced Bill of Quantities, and where no Items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related Items of Work.

1.8 General directions and descriptions of work and materials are not necessarily repeated nor summarized in the Bill of Quantities. References to the relevant sections of the Contract documentation shall be made before entering prices against each item in the priced Bill of Quantities.

1.9 Provisional Sums included and so designated in the Bill of Quantities shall be expended in whole or in part or not at all at the direction and discretion of the Engineer .

1.10 The method and unit of measurement of completed work for payment shall be in accordance with the method described in the specifications for each item or in the Bill of Quantities. For Lump Sum items, measurements for Interim Payment Certificates shall be based on percentage completion of such item of work or milestone as per the Contractor's proposed schedule of quarterly payments, as approved by the Engineer.

B. Descriptions of Items and Measurement Methods

INTRODUCTION

The descriptions of the different items in the Bills of Quantities and the method adopted for measurements are indicated in the following paragraphs.

The quantities shall be computed using dimensions from the drawings based on the pre-bid meeting or as varied by the Engineer, except where clearly stated otherwise under the following individual items. No allowance shall be made for settlement, bulking, shrinkage, or waste.

The B.1 items will be paid from Advance payment.

B.1 Bill of Quantities for Lot 1, Lot 2 and Lot 3

1 Contractor's site establishment

1.1 Establishment, maintenance, and removal of contractor's site facilities such as office, stores, services, security, etc.

The sub item provides for the establishment and removal on completion of all the facilities required by the Contractor for execution of the work under the contract including offices, stores, services, security workshops, housing etc.

1.2 Mobilization and demobilization of plant Equipment and machinery

The item provides for mobilization and demobilization, removal of Contractors equipment's including mobilization of all necessary equipment's to the site, removal of all rubbish & debris and clearing up site on completion, leaving all the good in order and handing over.

2 Health, Safety and Environment

2.1 Health and safety measures during construction confirming to the latest industrial standards

This sub item provides for all necessary Health, Environment Protection and safety items. This includes employing workmen to clean and maintain all areas to be in good hygienic conditions including toilets, wash areas, kitchen etc. supply adequate drinking water, after for washing purposes, soap, detergent, etc. throughout the period of construction.

Providing all necessary safety measures to workmen at site confirming to the latest industrial safety regulations and "The Guidance for the Management of Safety for Construction Works in Japanese ODA Projects" prepared by JICA and as directed by the engineer.

2.2 Environmental protection and precaution during construction

Environment protection shall include making adequate provisions against air and noise pollution of surrounding areas. Hording and dust screens to prevent escaping dust to surrounding areas. Maintaining the site in a clean and orderly manner at all times during entire contract period.

3 Insurances, Bonds and Securities

3.1 Insurance of works, contractor's equipment, third party, and workmen's compensation

The sub items provide for the provision of the different types of insurances as required in Article 16 of the General Conditions of Contract as lump sum items. This includes insurance of works, Machinery & Equipment, Plant, Materials, third party persons & Property and Employer's personal & property at site as per the Contract. Insurance against accidents and injury to Contractor's personnel as per the Contract.

3.2 Performance security

The item provides for the provision of Performance Security as required in Article 12 of the General Conditions of Contract (GCC) as a lump sum item.

3.3 Advance payment Security

The item provides for the provision of Security Bonds and Guarantees against advance payment etc. as required in the Contract as a Lump Sum item. The Contractor shall submit with his Bid a breakdown of the items that he wishes to be paid under this lump sum item.

4 Project Sign boards

4.1 Provide and maintain project signboards

The sub item provides for the supply, erection, maintenance and removal on completion of a Notice Board of min. 3 square metre giving details of the Project, Employer, Contractor and other details to be specified by the Engineer.

5 Site Investigation / Testing

5.1 Site investigation and Testing as directed by the Engineer

Engineers may instruct any additional investigation to be carried out which as a requirement of carrying out work this item may include but not limited to any soil testing. Ground investigation and etc. contractor should carry out each and every test based on the Engineer's request.

Testing of all material used for the work or intended to use for the work. Engineer may instruct additional test to be carried out as for the requirement of carrying out work.

6 Quality Standard and Progress

6.1 Provision for monthly progress reports and photograps and etc

The sub item is provided as a lump sum for the submission of Monthly Progress Reports and photographs, schedules etc.

6.2 Provide As-Built drawings, Quality Assurance reports.

The sub item is provided on a lump sum basis for the submission of As-Built Drawings, In general terms quality assurance includes measures to meet the required quality. It is necessary to prevent errors (not finding the mistakes),In our case it is based on a quality model which is a conceptual framework in which the abstract term of quality is gradually resolved into individual aspects. It typically consists of characteristics and parameters. A quality characteristic is an

inherent feature of a product or process, related to a requirement etc. as specified in the Contract and requested by the Engineer.

B.2 Bill of Quantities for Lot 1 and Lot 2

7. Horizontal Drainage Drilling

The bidder refer to the Lot 1 and Lot 2 of Bill of Quantities.

8. Gabion work

The bidder refer to the Lot 1 and Lot 2 of Bill of Quantities.

9. Surface Drainage Ditch

The bidder refer to the Lot 1 and Lot 2 of Bill of Quantities.

10. Water Collecting Pit

The bidder refer to the Lot 1 and Lot 2 of Bill of Quantities.

11. Small Dam

The bidder refer to the Lot 2 of Bill of Quantities.

B.3 Bill of Quantities for Lot 3

7. Earth Work

The bidder refer to the Lot 3 of Bill of Quantities.

8. Gabion work

The bidder refer to the Lot 3 of Bill of Quantities.

9. Drainage Work

The bidder refer to the Lot 3 of Bill of Quantities.

Section 4

FORM OF CONTRACT AGREEMENT
AND
GENERAL CONDITIONS OF CONTRACT

The Bidder should not complete the Form of Contract Agreement at this time.

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CONTRACT AGREEMENT

BETWEEN

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

AND

(NAME OF THE CONTRACTOR)

THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

FOR

THE PILOT PROJECT FOR LANDSLIDE AND ROCK FALL MITIGATION WORKS

LOT 1, LOT 2 OR LOT 3

UNDER

THE TECHNICAL COOPERATION FOR LANDSLIDE MITIGATION PROJECT

CONTRACT AGREEMENT

THIS CONTRACT AGREEMENT, made and entered into on this **th day of ****, 2015 and between JAPAN INTERNATIONAL COOPERATION AGENCY (JICA), JAPAN, represented by his Representative Office in the Democratic Socialist Republic of Sri Lanka, (hereinafter referred to as "the Employer") and (name of the contractor), duly organized and existing under the laws of the Democratic Socialist Republic of Sri Lanka, having its principal office of business at (address of the contractor), (hereinafter referred to as "the Contractor"),

WITNESSETH:

WHEREAS, JICA extends its Pilot project for Landslide and Rock fall mitigation works for the Democratic Socialist Republic of Sri Lanka, on the basis of the Record of Discussions for "The Technical Cooperation for Landslide Mitigation Project" signed on the 7th of March 2014 agreed between the Democratic Socialist Republic of Sri Lanka and JICA;

WHEREAS, the Employer, as a competent authority for the Project, is desirous of having the Work for the Project carried out by the Contractor; and

WHEREAS, the Contractor is willing to execute the Work on the terms and conditions as set forth in this Contract;

NOW, THEREFORE, in consideration of the mutual covenants hereinafter contained, the parties agree as follows:

Now this Agreement witness as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the General Conditions of Contract hereinafter referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement, namely:

    - The Contract Agreement
    - The Letter of Acceptance
    - General Conditions of Contract
    - Technical Specifications
    - Contractor's Bid
    - Drawings
    - Other addenda, if any, that are issued prior to the signing of this Contract

3. In consideration of the payments to be made to the Contractor by the Employer as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Work and remedy any defects therein in conformity with all respects with the provisions of the Contract.
4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Work and the remedying of defects therein the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

5. The Contract Price to be paid to the Contractor by the Employer subject to the requirements of the Contract Document is:

   Amount in words (Rs. Figure, excluding the VAT)

   The payment schedule is described in Article 6.3of the General Conditions of Contract.
   The payment from the Employer to the Contractor shall not include VAT.
   The VAT for the payment shall be paid by NBRO to the Contractor.
   The Contract price is changeable as per Article 2 of the General Conditions of Contract.

6. The time for completion of the Work shall be within (days in word, Figure) from the Commencement Date.

   The Defect Liability Period shall be twelve (12) months calculated from the date of issue of "the Certificate of Completion of the Work" according to Article 10 and 11 of the General Conditions of Contract.

7. This Agreement shall become effective upon the latest date when the following conditions have been satisfied:
   a) Each of the parties has signed this Agreement
   b) Necessary approval on this Agreement has been made by JICA.

8. The Contractor's Bank particulars and Account Number to which the payments are due shall be credited in respect of this Project.

Name of Bank	:
Name of Branch	:
Address of Bank	:
Beneficiary	:
Account Number	:

IN WITNESS WHEREOF the parties hereto have caused this Agreement to be executed the day and year first above written.

The Contractor	The Employer
(Signature)	(Signature)
	Mr. Kiyoshi AMADA Chief Representative, Japan International Cooperation Agency Sri Lanka Office
Democratic Socialist Republic of Sri Lanka	10th and 13th Floors, DHPL Building, No.42, Navam Mawatha, Colombo 02, Sri Lanka

Witness

(Signature)

Dr. Asiri Karunawardana
Director General
National Building Research
Organization (NBRO)
Democratic Socialist Republic of
Sri Lanka

GENERAL CONDITIONS OF CONTRACT

FOR

THE PILOT PROJECT FOR LANDSLIDE AND ROCK FALL MITIGATION WORKS

LOT 1, LOT 2 OR LOT 3

UNDER

THE TECHNICAL COOPERATION FOR LANDSLIDE MITIGATION PROJECT

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Article 1. Definitions

In the Contract (as hereinafter defined) the following words and expressions shall have the meanings hereby assigned to them, except where the context otherwise requires.

Words importing the singular only also include the plural and vice versa where the context requires. Words indicating one gender include all genders.

"The Project" means The Pilot Project for Landslide and Rock fall mitigation works under the Technical Cooperation for Landslide Mitigation Project in conformity with the Scope of Work.

"The Employer" means the Japan International Cooperation Agency (JICA), represented by his Representative office in the Democratic Socialist Republic of Sri Lanka and shall include any person or persons authorized by JICA.

"The Recipient" means the Government of Democratic Socialist Republic of Sri Lanka who receives the Grant for the Project from JICA and takes over the Work from the Contractor upon completion thereof pursuant to Article 10.2 hereof.

"The Contractor" means (name of the contractor) who shall legally and actually exist in the Democratic Socialist Republic of Sri Lanka and shall include any person or persons authorized by the Contractor under this Contract.

"The Subcontractor" means any person named in the contract as a Subcontractor for a part of the Work or any person to whom a part of the Work has been subcontracted with the consent of the Engineer and the legal successors in title to such person, but not any assignee of any such person.

"The Engineer" means National Building Research Organization (NBRO), an organization duly organized and existing under laws of the Democratic Socialist Republic of Sri Lanka, No. 99/1 Jawatte Road, Colombo 05, Sri Lanka, and the Joint Venture Consultant team consisting of Earth System Science Co., LTD. a company duly organized and existing under laws of Japan, having its principal office of business at 7F Shinjukumarune Bldg.1-23-1, Shinjukuku, Shinjuku, Tokyo, 160-0022 Japan and Nippon Koei Co., Ltd., duly organized and existing under laws of Japan, having its principal office of business at 5-4 Kojimachi, Chiyodaku, Tokyo, 102-8639 Japan, who are appointed by the Employer to support NBRO for the purposes of providing technical supervisory work relating to the Contract and shall include any person or persons authorized by the Employer.

"The Contract" means this contract concluded between the Employer and the Contractor.

"The Contract Documents" means the documents consisting of the following and are incorporated

in and made part of this Contract, as though fully written out and set forth herein.

1) Contract Agreement
2) Letter of Acceptance
3) General Conditions of Contract
4) Technical Specifications
5) Contractor's Bid
6) Drawings
7) Addenda that shall be issued prior to the signing of the Contract, if any, and other documents intended to form the Contract

"The Party" means the Employer or the Contractor, as the context requires, and "Parties" means both of them.

"The Specification" means the specification of the Work included in the Contract and any modification thereof or addition thereto made under the related article of the contract documents or submitted by the Contractor and approved by the Engineer.

"The Drawing" means all drawings, calculations and technical information of a like nature provided by the Engineer to the Contractor under the Contract and all drawings, calculations, samples, patterns, models, operation and maintenance manuals and other technical information of a like nature submitted by the Contractor and approved by the Engineer.

"The Bid" means the Contractor's priced offer to the Employer for the execution and completion of the Work and the remedying of any defects therein in accordance with the provisions of the Contract, as accepted by the Letter of Acceptance.

"The Letter of Acceptance" means the formal acceptance by the Employer of the bidder.

"The Commencement Date" means the date of commencing the Work in accordance with Article 4.1 herein.

"**Time for Completion**" means the time for completing the execution of and passing the tests on completion of the Work as stated in the Contract calculated from the Commencement Date.

"**Certificate of Completion of the Work**" means a certificate issued pursuant to Article 10 hereof.

"The Contract Price" means the price defined in Article 6 hereof, and includes adjustments in accordance with Article 6 hereof.

"The Work" means the construction works for the Project to be rendered by the Contractor as described in Article 3 of this Contract.

"**Site**" means the places secured by the NBRO where the Works are to be executed and any other places as may be specifically designated in the Contract as forming part of the site.

"**Day**" means Gregorian calendar day.

"**Writing**" means any hand-written, type-written, or printed communication, including facsimile transmission.

Article 2. Basis of Contract

2.1 Any and all stipulations of this Contract shall be consistent with the content of the Scope of Work. Should any of the stipulations of this contract be in conflict with the Scope of Work, such stipulations shall be deemed null and void ab initio.

2.2 The Contract Price shall be subject to change according to the actual completion of work quantities and shall be recalculated agreed between the Employer and the Contractor.

Article 3. Scope of Work

3.1 All works to be rendered under this Contract shall consist of the following items specified in the Contract Documents.

The Work

Lot 1 Horizontal drainage drillings, Gabion works and Surface drainage ditch works at Badulusirigama/ Uva Wellasa University in Badulla District, Uva Province. (Landslide mitigation works)
or

Lot 2 Horizontal drainage drillings, Gabion works and Surface drainage ditch works at Udamadura in Nuwara Eliya District, Central Province. (Landslide mitigation works)
or

Lot 3 Earth works (Crushing rock, Embankment and Stone pitching) Gabion works and Drainage works at Alagumale in Matale District, Central Province. (Rock fall mitigation works).

3.2 The Scope of the Work prescribed in Article 3.1 above shall include site survey, design and supply for performance test, transportation, insurance and all other things required in and for the Project implementation in due conformity with the Contract Documents.

3.3 The extent of the Project prescribed in Article 3.1 may be amended and modified pursuant to mutual agreement in writing under this Contract.

Article 4. Period of Execution of Work

4.1 The Contractor shall commence the Work within seven (7) days from the date of receipt of the notice of the commencement of the Work issued by the Employer.

4.2 The Contractor is expected to complete the Work on or before the **th day of ******, 2017, if the Work can be commenced at the beginning (in the middle, at the end) of February 2016.

Article 5. Remuneration

5.1 Contract Price

The Employer shall remunerate the Contractor with a total amount of Sri Lankan Rupees ******* **million ******** thousand ******* (Rs. ***, ***, ***)** (excluding the VAT) as the Contract Price for the Work, in accordance with the payment schedule stated in Article 6.3 of this Contract.

Article 6. Payment

6.1 Terms of Payment

The payment shall be made through bank account of the Employer which shall be existing in the Democratic Socialist Republic of Sri Lanka to the Contractor's bank account in the Democratic Socialist Republic of Sri Lanka or in any other country as an International and first ranked bank accepted by the Employer.

The currency unit of payment shall be the Sri Lankan Rupees (Rs.). Any bank charge, commission and/or other required charges of transferring money through the bank shall be borne by the beneficiary i.e. the Contractor.

6.2 Items of the Work for which no rate or price has been entered in will not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.

6.3 Payment schedule

(1) Advance Payment

********** million ********** thousand (Rs **, ***, 000), which corresponds to Twenty percent (20) of the Construction Price, shall be paid by the Employer within fourteen (14) days after

submission of Advance Payment Security stipulated in Article 13 hereunder. The request for the advance payment shall be accompanied with the Advance Payment Security.

(2) Interim Payment

2.1 The Interim Payment shall be paid in March, June, September and December according to the progress. The amount of each interim payment shall be calculated based on the Quarterly progress report for the past three (3) months of each month to be paid.

2.2 The Engineer shall check the Contractor's Quarterly progress report and certify the amount to be paid to the Contractor within 21 days of the receipt of the Contractor's statement.

2.3 The value of work executed shall be determined by the Engineer and comprise the value of the quantities of the items in the Bills of Quantities completed.

2.4 The request for the Interim Payment shall be accompanied with the certificate of progress of works issued by the Engineer after checking quarterly progress report which was submitted by the Contractor. The Employer shall pay the Contractor the amounts certified by the Engineer within 14 Days of the date of each certificate.

2.5 The retention from each interim payment shall be ten percent (10%) of the certified work done.

(3)Final Payment

********** million ********** thousand (Rs **, ***,000), which corresponds to ten (10) percent of the Contract Price, shall be paid within fifty six (56) days after submission of Retention / Maintenance Security stipulated in Article 14 hereunder, after the certificate of completion of the Work under this Contract issued by the Engineer under the approval of Employer. The request for the final payment shall be accompanied with the certificate of completion of the Work and the Retention / Maintenance Security.

6.4 In case any amendments and/or modifications of the Contract Price are necessary in accordance with Article 23, the payment shall be adjusted accordingly.

Article 7. Employer's Responsibilities

7.1 The Employer shall carry out the following works in time for the commencement of the Work;

(1) To obtain a permission to utilize required land area for implementation of the project prior to the commencement of work,

(2) To obtain permission to utilize land area, if required, for a temporary site office, warehouse, stock yard and motor pool during the contract period.

7.2 The Employer shall assist the Contractor to collect data and information necessary for implementation of the work.

7.3 The Employer shall cooperate with the resident representative of the Contractor in the negotiations and procedures with the various authorities concerned and public and private organizations for the execution of the Work.

Article 8. Contractor's Obligations

8.1 The Contractor shall perform the Work in accordance with the Contract Documents.

8.2 The Contractor shall, with due care and diligence, execute and complete the Work and remedy defects therein in accordance with the provisions of the Contract. The Contractor shall provide all superintendence, labor, materials, and plant. Contractor's equipment and all other things, whether of a temporary or permanent nature, required in and for such design, execution, and completion and remedying of any defects, so far as the necessity for providing the same is specified in or is reasonably to be inferred from the Contract.

8.3 The Contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the Bid, all of which shall, except insofar as it is otherwise provided in the Contract; cover all his obligations under the Contract including those in respect of the supply of goods, materials, plant or services or of contingencies and all matters and things necessary for the proper execution and completion of the Work and the remedying of any defects therein.

8.4 Unless it is legally or physically impossible, the Contractor shall execute and complete the Work and remedy defects therein in strict accordance with the Contract to the satisfaction of the Engineer. The Contractor shall comply with and adhere strictly to the Engineer's instructions on any matter, whether mentioned in the Contract or not, touching or concerning the Work. The Contractor shall take instructions only from the Engineer.

8.5 The Contractor shall survey and examine the condition of the site and its surroundings and shall collect information available in connection therewith and have satisfied himself before starting site work;

(1) The nature and character of surroundings adjacent to the project site including unexplored ordinances, landmines, and people's daily activity for avoiding any conflict caused by the execution of the Work.

(2) The extent and nature of work and materials necessary for the execution and Completion of the Work and the remedying of any defects therein

(3) The necessary information which may influence to the Work for avoiding any disturbance to maintaining smooth operation of the Work.

8.6 The Contractor shall prepare shop drawings, progress schedules, safety plan, method statements on safety and other technical documents required by the Engineer.

(1) The Contractor shall submit the Method Statements on Safety to the Engineer no later than seven (7) days prior to the commencement of the relevant works according to the execution plans or their equivalent document.

(2) The Method Statements on Safety, prepared and submitted by the Contractor, shall be reviewed by the Engineer from the viewpoint of maintaining safety during the Work at site.

8.7 The Contractor shall submit to the Engineer a Construction method statement including construction program, quality control method, safety plan, safety and health control plan, manning schedule, shop drawings and other required data and documents before starting the Work.

During implementation period, the Contractor shall submit to the Engineer a daily and monthly progress report, material test result and daily quality control report and other technical documents required by the Engineer.

8.8 The Contractor shall submit to the Engineer the list of country/area of origin of the materials which the Contractor proposes to purchase for the Work.

8.9 The Contractor shall be responsible for the implementation means, methods, techniques, sequences or procedures, quality control and safety and health control in connection with the Work.

8.10 The Contractor shall be responsible for the acts or omissions of the Contractor's subcontractors, or any of the Contractor's agents or employees, or any other persons performing any part of the Work for the Contractor.

8.11 The Contractor shall furnish one (1) resident representative with sufficient faculty to execute the Work at the Project Sites.

8.12 The Contractor shall bear the handling charges, customs clearance charges, storage charges, and transportation expenses related to the importation of the materials for the Work.

8.13 The Contractor shall, at his own expense, take necessary measures in accordance with the Contract Documents and relevant laws, ordinances and regulations to prevent damage to the Work, construction materials, adjacent structures, or the Third Parties, until the completion and delivery of the Work.

8.14 The Contractor shall, whenever he considers it especially necessary for the prevention of accidents, take appropriate measures, asking in advance for the Employer's opinion.
Provided the Employer considers it necessary to take appropriate accident preventive measures, and may have so required them from the Contractor, the latter should comply therewith.

8.15 If the Employer suffers damage as a result of a default by the Contractor in the execution of its obligations under the Contract, the Employer and the Contractor shall consult mutually to settle such matters. If both Parties cannot reach agreement within twenty eight (28) days from the date of the notice, both Parties shall comply with the dispute settlement process stipulated in Article 21 hereof.

8.16 The Contractor shall, to the maximum extent possible, employ workers from the immediate vicinity of the Site and shall select such employees on the basis of competence, efficiency and skill in the various occupations and trades.

Article 9. Engineer's Duty and Authority

9.1 The Engineer will be responsible for any technical supervision for the Project implementation of the Contract. The Engineer shall not, however, have the right to make final decision on any matter relating to Change, Modification and/or Variation order or similar character and nature of contractual issue without the approval of the Employer.

9.2 The Engineer shall, as a daily supervisory work on the project site, be authorized by the Employer for any Approval, Observation, Certification, Agreement, Inspection, Instruction, Notice, Suggestion, Request, Testing, and/or similar works required for the smooth implementation of the Contract.

Article 10. Inspection and Delivery

10.1 Upon completion of the Work, the Contractor shall request a final inspection of the Engineer for the Work.

10.2 When the Work has passed the final inspection conducted by the Engineer, the Engineer shall issue the Certificate of Completion of the Work under Employer's approval and thereupon the Work shall be delivered to the Recipient.

Article 11. Warranty against Defects

11.1 The Contractor shall guarantee all the Work to be executed in accordance with the Contract Documents for a period of twelve (12) months from the date of issue of Certificate of Completion of the Work.

11.2 The Employer and the Recipient shall notify the Contractor in writing as stipulated in Article 28 hereof, of any defects for which a claim is made under this warranty as promptly as possible after discovery thereof.

The Employer and the Recipient's written notice shall describe the nature and extent of the defects. The Contractor shall have no obligation for any defects discovered subsequent to the expiry date of the said twelve (12) month period, unless notice of such defects is received by the Contractor not later than twenty one days(21) after such expiry date.

11.3 The Contractor shall remedy, at his own expense, any defects by making all necessary measures for repair or replacement.

11.4 After confirmation with Recipient that no defects on the work has not be identified during warranty period or all the defects which have been claimed with the Employer and Recipient have been remedied by the Contractor, the Engineer shall issue the Defects Liability Certificate to the Contractor under the Employer's approval.

11.5 The Contract shall not be considered as completed until a Defects Liability Certificate has been signed by the Engineer under the Employer's approval and has been delivered to the Contractor, stating the date on which the Contractor shall have completed his obligations to execute and complete the Work and remedy and defects therein to the Engineer's satisfaction.

11.6 The Contractor shall confirm whether what phenomena shall be deemed as defects with the Engineer and the Employer in advance of commencement of the project.

Article 12. Performance Security

12.1 The Performance security shall be valid until the Contractor has executed and completed the Work in accordance with Article 10.2 hereof.

12.2 The Contractor shall provide a Performance Security of five percent (5%) of the contract price to the Representative office of the Employer in the Democratic Socialist Republic of Sri Lanka within fourteen days (14) after receiving the Letter of Acceptance.

12.3 The Performance Security shall secure the proper execution of all the Contractor's obligations during the period from the date of signing of this Contract to the date of issuance of the Certificate of Completion of the Work.

12.4 The Performance Security shall be released immediately after submission of Maintenance Security from the Contractor after the issuance of the Certificate of Completion of the Work.

Article 13. Advance Payment Security

13.1 The Contractor shall provide an Advance Payment Security of equivalent value of twenty percent (20%) of the payment of Contract Price to the Employer when the Contractor shall claim an advance payment to the Employer.

13.2 The Advance Payment Security shall secure the repayment of any sum advanced by the Employer upon the Contractor's default from the date of the advance payment to the date of the issuance of the Certificate of Completion of the Work.

13.3 The amount of the Advance Payment Security shall cover the amount to be paid as the advance payment for the Work, but only to pay for Equipment, Plant, Materials, and mobilization expenses required specifically for execution of the Contract. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the Engineer.

13.4 Prior to requesting the advance payment, the Contractor shall obtain the Advance Payment Security and the Employer shall have the custody of the Advance Payment Security. Such security shall be returned to the Contractor immediately after submission of Maintenance Security from the Contractor after the issuance of the Certificate of Completion of the Work.

13.5 In making a claim under the Advance Payment Security, the Employer shall notify the financial institution of said security in writing, stating the nature of the defect and the amount of damages in respect of the claim.

13.6 The amount to be paid under the claim shall be the amount of the actual damage incurred, and in no case shall it exceed, the amount of the Advance Payment Security.

Article 14. Maintenance Security

14.1 The Contractor shall provide and submit a Maintenance Security of five percent (5%) of the Contract

price to the Employer for twelve months (12) defect liability period at the same time when the Contractor receives the Certificate of Completion of the Work.

14.2 No claim shall be made against such security after the issue of the Defects Liability Certificate and such security shall be returned to the Contractor within fourteen days (14) of the issue of the said Defect Liability Certificate.

The Defects Liability Certificate shall be given to the Contractor by the Engineer within fourteen days (14) after the expiration of the Defects Liability Period.

Article 15. Currency of the Contract

15.1 The Applicable Currency of the Contract price and all of the settlement under this contract shall be in Sri Lankan Rupees (Rs).

15.2 All payment and Security/ Guarantee/ Bond described in Articles 12, 13, 14 and other related Articles and Clauses shall be in Sri Lankan Rupees (Rs).

15.3 Aforesaid Security shall be issued by the international and/or first class bank or bonding or insurance company duly existing and operating in the Democratic Socialist Republic of Sri Lanka including foreign organizations which are established and operated in the Democratic Socialist Republic of Sri Lanka, and approved by the Employer.

Article 16. Insurance

16.1 The Contractor shall provide, in the joint name of the Employer, the Engineer and the Contractor, insurance cover from the commence date to the end of the Defect Liability Period for following events which are due to the Contractor's risks.

The insurance policy should cover for special natural perils like Earthquake, Volcanism, Storm, Cyclone, Landslide and Rock fall.

(a) The minimum coverage of insurance for loss of, or damage to the Work, Equipment, Plant and Materials shall be One hundred ten percent (110%) of the Contract amount, with a maximum deductible of Twenty percent (20%).

(b) The minimum coverage of insurance for loss, or damage to property, except the Work, Plant, Materials and Equipment, is Twenty percent (20%) of the Contract amount with a maximum

deductible of Fifty percent (50%).

16.2 The Contractor shall provide Workman Compensation Insurance in the joint name of the Employer, the Engineer and the Contractor.

(a) The minimum coverage of insurance for Workman Compensation Insurance for personal injury or death caused by the Work shall be Ten percent (10%) of the Contract with no deductible.

16.3 The Contractor shall also provide Third Party Liability Insurance.

(a) The minimum coverage of insurance for Third Party Liability for property, or personal injury or death caused by the Work shall be Ten percent (10%) of the Contract amount with no deductible.

16.4 Aforementioned insurance shall be applied and become effective on or just before commencing the Work. And the Contractor shall submit Two (2) clear photocopies of proper certificates and those policies of the insurance for aforementioned each item to the Engineer reasonably before commencing the Work.

Article 17. Liquidated Damages

17.1 The Contractor shall pay liquidated damages to the Employer at the rate of Zero point one percent (0.1%) per day of the Final Contract amount.

17.2 The countable delayed days for liquidated damages shall start from following day of the date for completion of the Work specified in Article 4.2 hereof until actual completion date of all the works.

17.3 The total amount of liquidated damages shall not exceed Ten percent (10%) of the Final Contract amount.

17.4 The Employer may deduct liquidated damages from any payments due to the Contractor. Payment of liquidated damage shall not affect the Contractor's liabilities.

Article 18. Assignment and Subletting

Neither of the Parties hereto shall assign this Contract or any part thereof to any Third Party without prior written consent of the other Party. The Contractor shall not sublet the whole of the Work or a major part of the Work to any Third Party together with its responsibility.

Article 19. Force Majeure

19.1 Definitions

Neither Party shall be deemed to be in default or in breach of this Contract if he is unable to perform his obligations under this Contract owing to circumstances beyond his reasonable control or coverage of the insurance. Such circumstances (hereinafter referred to as "Force Majeure") shall include, but shall not be limited to, the following:

a) war (declared or undeclared), hostilities, invasion, act of any foreign enemy, threat of or preparation for war; terrorism, riot, insurrection, civil commotion, rebellion, revolution, usurped power, civil war; and labor troubles or other industrial troubles, strikes, embargoes, blockades, and sabotage of labor.

19.2 Monetary Obligations

Notwithstanding the foregoing, the occurrence of Force Majeure shall not prejudice nor otherwise affect either Party's liability to pay remuneration or reimbursement of expenses to which the other Party is entitled on or before the date of occurrence.

19.3 Notice

The Party affected by Force Majeure shall give the other Party a written detailed account of the circumstances of Force Majeure as soon as practicable, but not later than fourteen (14) days from the occurrence.

19.4 Expatriate Staff

In the event that Force Majeure is likely to endanger the safety of any expatriate staff members of the Contractor, they shall be allowed to leave the site and/or office, giving notice to a staff member of the Employer responsible for the management of the Work as soon as possible.

19.5 Suspension

Upon occurrence of Force Majeure, the Party affected may be allowed to temporarily suspend the performance of his duties under this Contract for so long a period as Force Majeure continues and as his performance is prevented thereby. In such instance, he shall make all reasonable efforts to mitigate the effect of Force Majeure upon his duties.

Article 20. Applicable Laws

This Contract shall be governed by and interpreted in accordance with the laws of the Democratic Socialist Republic of Sri Lanka.

Article 21. Disputes and Arbitration

21.1 This Contract shall be executed by the Parties hereto in good faith, and in case any doubtful point is raised or any dispute occurs concerning the interpretation or performance of this Contract, such matters shall be settled through consultation of the Parties. Unless the Contract has already been abandoned, repudiated or terminated in accordance with Article 25 hereof, the Contractor shall continue to perform the Work in accordance with this Contract. If the Parties cannot reach an agreement within thirty (30) days from the date of the notice informing the occurrence of such matters, the Employer will offer its suggestion for the settlement of the matter.

21.2 In the event that an amicable settlement cannot be reached through consultation referred to in the Article 21.1 above, the matter shall be referred to arbitration. The arbitration shall be conducted in accordance with the Rules of Arbitration of the International Chamber of Commerce.

21.3 The arbitration shall be conducted in English.

21.4 The place of arbitration shall be in Singapore or Malaysia

21.5 The arbitral award shall be final and binding upon the Parties hereto and the Parties shall comply in good faith with the decision. Judgment upon the award may be entered in any court having jurisdiction or application may be made to such court for juridical acceptance of the award or order of enforcement as the case may be.

21.6 As for fees for all proceedings for arbitration, each Party shall bear the costs of his own arbitrator's service and an equal share of the costs for the third arbitrator.

Article 22. Language and Measurement System

22.1 All correspondence between the two Parties including notices, requests, consents, offers, and demands shall be made in English. All drawings, specifications, reports, and other documents shall also be prepared in English.

22.2 All documents made under this Contract shall adopt the metric system and the Gregorian calendar day.

Article 23. Project Modifications

23.1 In case the Employer considers any modifications of the Work necessary, the Employer shall discuss the solution with the Engineer, and the modifications can be made subject to the prior consent by

JICA HQs. Each modification may include:
(a) obvious change in appearance of the building or facilities,
(b) change of the Project Site,
(c) change of major structure and/or strength of the building or facilities,
(d) change of dimensions of the building or facilities,
(e) change of the period of execution of the Work,
(f) change of terms and/or amount of the Contract Price.
(g) change that requires amendment of the verified contract, and
(h) other changes for which JICA HQs requires the Employer to obtain its prior consent.

In addition to the changes mentioned above, modifications can be made on an ex-post facto report to the Employer within the criteria of minor modifications set by the Employer.

23.2 Proposal by the Contractor
In case the Contractor considers any modifications of the Work necessary, the Contractor shall discuss the solution with the Engineer, and the Contractor can propose the modifications to the Employer. This proposal may include the changes from (a) to (h) mentioned in Article 23.1.

23.3 Procedures
Modifications shall be agreed upon by the Parties and Employer's consent shall be obtained for the modifications. Details of the procedures for such modifications are advised by Employer.

Article 24. Amendments and Modifications

Any amendments and/or modifications, such as caused by unforeseeable underground obstructions and/or physical conditions, if necessary, may be negotiated between the Parties hereto and shall be agreed by a written document signed by both Parties.

Article 25. Early Termination

25.1 Should either Party default in the execution of his obligations under this Contract, the other Party shall give the defaulting Party notice in writing to remedy such default promptly.

25.2 Failure of the defaulting Party, to take corrective measures as required by the other Party within thirty (30) days of the receipt of such notice, shall constitute a sufficient cause for the other Party to terminate this Contract.

25.3 Either Party may terminate this Contract without prejudice, should the performance of his obligations under this Contract not be resumed within a cumulative period of sixty (60) days of

suspension due to Force Majeure stipulated in Article 19 hereof.

25.4 The early termination of this Contract under this Article shall be subject to the approval of the competent authorities of the Employer.

25.5 In the event of early termination for reasons stated in Article 25.2 and 25.3, the Contractor shall be paid by the Employer, a fair and reasonable proportion of the Contract Price that is calculated on the basis of the Contractor's works carried out up to the termination date and the Contractor's Bill of Quantities, instead of the payment schedule stipulated in Article 6 hereof.

Article 26. Interpretation

26.1 All general language or requirements embodied in the specifications are intended to amplify, explain and implement the requirements of this Contract. However, in the event that any language or requirements so embodied permit an interpretation inconsistent with any provisions of this Contract, then in each and every such event, the applicable provisions of this Contract shall prevail and govern.

26.2 The specifications and drawings are also intended to explain each other, and anything shown on the drawings and not stipulated in the specifications or vice versa shall be deemed and considered as if embodied in both. In the event of conflict between the specifications and drawings, the specifications shall prevail and govern.

Article 27. Entire Agreement

This Contract sets forth the entire agreement between the Parties in respect of the subject matter hereof and supersedes and cancels any and all previous agreements, negotiations, commitments, and writings in respect of the subject matter thereof.

Article 28. Notice

All notices pertaining to this Contract between the Employer and the Contractor shall be sent in writing by registered airmail, facsimile, electronic mail or shall be handed to the addresses so stated herein. Such notices shall take effect from the date of receipt by the other Party. In case either Party hereto changes the address, the Party concerned shall give such notice to the other Party beforehand.

The Employer:

Name : Japan International Cooperation Agency (JICA)
Sri Lanka Office
Address : 10th and 13th Floors, DHPL Building, No.42, Navam Mawatha,
Colombo 02, Sri Lanka
Telephone : 94-011-2300470
Facsimile : 94-011-2300473

The Contractor:

Name :
Address :
Telephone :
Facsimile :
E-mail address :

IN WITNESS WHEREOF, the Parties hereto have caused this Contract to be signed, as of the day and year first above written, in their respective names in duplicate, each Party retaining one (1) original copy thereof.

The Contractor	The Employer
(Signature)	(Signature)
	Mr. Kiyoshi AMADA Chief Representative, Japan International Cooperation Agency Sri Lanka Office
Democratic Socialist Republic of Sri Lanka	10th and 13th Floors, DHPL Building, No.42, Navam Mawatha, Colombo 02, Sri Lanka

Witness

(Signature)
Dr. Asiri Karunawardana
Director General
National Building Research
Organization (NBRO)
Democratic Socialist Republic of
Sri Lanka

VOLUME II

TECHNICAL SPECIFICATIONS

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Section 5
Instructions for Technical Specifications

The Work consist of three (3) Lots shown below.

Lot 1: Landslide Mitigation Works at Badulusirigama/ Uva Welassa University in Badulla District , Uva Provinces including the works shown below.

- Horizontal Drainage Drilling
- Gabion Works
- Surface Drainage Ditch Works

Lot 2: Landslide Mitigation Works at Udamadula in Nywara Eliya District, Central Provinces including the works shown below.

- Horizontal Drainage Drilling
- Gabion Works
- Surface Drainage Ditch Works
- Small dam

Lot 3: Rock Fall Mitigation Works at Alagmale in Matale District, Central Provinces including the works shown below.

- Excavation
- Crushing Rock
- Embankment
- Ground levelling
- Stone Pitching

Technical Specifications shall be applied for each lot shown below.

Lot 1 :

- Specification for Civil Works
- Specification for Earth Work
- Specification for Surface Drainage Ditch
- Specification for Horizontal Drainage Drilling
- Specification for Gabion Box
- Specification for Geotextile

Lot 2 :

- Specification for Civil Works

- Specification for Earth Work
- Specification for Surface Drainage Ditch
- Specification for Horizontal Drainage Drilling
- Specification for Gabion Box
- Specification for Geotextile

Lot 3 :

- Specification for Civil Works
- Specification for Earth Work
- Specification for Gabion Box
- Specification for Geotextile

Section 6
SPECIFICATIONS FOR CIVIL WORKS

GENERAL TECHNICAL SPECIFICATIONS

ICTAD Publication No. SCA/3/1 – 'Specifications for Irrigation and Drainage Works' and ICTAD Publication No. SCA/A/5 – 'Specifications for Roads and Bridges – Revised 2009, are applicable as the general specifications for the Civil Works of this Contract to relevant items.

Where there is a discrepancy between two general specification, Specification for Irrigation and land drainage work supersede.

These publications are not issued with the Bidding Document package and the Bidder/Contractor should obtain them from a suitable source.

PARTICULAR TECHNICAL SPECIFICATIONS

Where there is a discrepancy between two general specification and particular specifications, Particular specification supersede.

1 INTRODUCTION

The following Particular Specifications are part of the requirements for the work related to the Civil Works which are to be provided according to the stipulations of the Contract. Hence, the instructions given herein form an integral part of, and are applicable to, all technical and Contract Documents issued for the Work. Addenda to these Specifications may be issued as required during the construction phase.

These Particular Technical Specifications shall be read in conjunction with General Technical Specifications (ICTAD), the Conditions of Contract and the Bidding Drawings. The Contractor shall comply with all provisions contained within the Contract Documents.

The General Technical Specifications and the Particular Technical Specifications in conjunction with the Bidding Drawings define the technical standard and quality to be achieved during construction.

The Particular Technical Specifications include the following subsections:

	Paragraph
Contractor's submittals and Engineer's approval	2
Site installation, services and environmental obligations	3
Safety and health precautions	4
Site supervision and reporting	5
Design documents and construction drawings	6
Preparation of As-built drawings	7

It is the intent of these Specifications, together with other relevant documents issued as part of the Contract Documents or to follow later on, to provide the Contractor with complete and detailed information and subsequent instructions necessary to enable him to carry out the design, where and when required, and to execute properly the work prescribed.

It is the intent of these Particular Specifications to establish acceptable standards of quality. On the other hand they shall also allow the construction of the Work in an efficient and economical way. Minor deviations in details due to selected work procedures and due to manufacturer's standard shop process will be considered for acceptance provided that, in the opinion of the Engineer, the proposed substitutions are equal in quality to those specified.

The Drawings available shall serve as a basis for detail design drawings to be produced by the Contractor.

All work shall be executed according to the Drawings and requirements released for construction, in a professional and diligent manner, and all supplies and work shall comply with the quality requirements defined in the relevant Sections of these Specifications and other Contract Documents. The Contractor shall provide all necessary efforts to comply with the intent of the General and Particular Specifications to the satisfaction of the Engineer.

2 CONTRACTOR'S SUBMITTALS AND ENGINEER'S APPROVAL

The Contractor shall provide the Engineer with all submittals as requested in these Specifications and other Contract Documents. Although their extent shall be to the discretion of the Contractor, they shall be complete enough to illustrate adequately their intent and facilitate full for the understanding of the Engineer.

At any time the Engineer may call for additional information, completion of the submittals.

The Contractor shall submit these documents to the Engineer so that, even if not specifically expressed, reasonable time will be given to the Engineer to comment or approve the submittals. The approval of the Engineer shall always be given in written form prior to the commencement of any work under this Contract and the Contractor shall not be paid for any work that is performed without the express written approval or instruction by the Engineer.

3 SITE INSTALLATION, SERVICES AND ENVIRONMENTAL OBLIGATIONS

3.1 General

3.1.1 Scope of work

The Contractor shall be responsible for providing plant, equipment, materials and labour for the provision of all necessary site installations and services adequate for the realisation of the Work under this Contract.

The Contractor shall design, furnish, install, maintain and operate all site installations and Contractor's equipment for his own use and for the use of the Engineer and Subcontractors, and as required for third parties, including workshops, warehouses, storage and assembly areas, all machinery, vehicles, scaffolding, equipment, water and power supply, etc.

Site installations and services provided by the Contractor for his own use as well as for that of the Engineer or for third parties shall conform to the applicable standards, codes and sanitary requirements set down by the Sri Lankan authorities for such purpose.

The construction, operation and maintenance of the Contractor's site installations and services shall be subject to inspection and written consent by the Engineer.

All plants, facilities, installations and services for the Contractor's and Engineer's use shall at all times remain the Contractor's property, except as specified hereinafter. Should the Contractor wish to sell his plant after the Completion of the Contract facilities and equipment in the country of the Work, he shall pay any and all taxes and duties required by law as stipulated in the Conditions of Contract.

The scope of the Work includes but is not limited to following site installation parts:

a) All temporary structures required for the performance of the work such as access roads, temporary construction roads or temporary working platforms
b) Stores, Warehouses, Materials Yards
c) Materials testing laboratory
d) Construction equipment
e) Power supply and illumination
f) Water supply

g) Sanitation, sewerage and waste disposal
h) Communication System
i) Site security

All installations of any Subcontractors shall comply with these Specifications.

3.1.2 Submittals

Within 30 days from the date of contract award the Contractor shall submit to the Engineer updated layout plans showing, at adequate scale, the locations and arrangement of all site installations. These plans shall be consistent with the plan submitted by the Contractor with his Bid as well as with any amendments and additions.

Within 14 days from the date of contract award the Contractor shall submit to the Engineer an updated project schedule on paper and as soft copy in Microsoft MS Project form showing all the activities he intends to perform to meet his obligations in is contract and to complete the work within its stipulated time for completion. This baseline schedule will be used for monitoring progress each month and for evaluating the impacts of any departures from the baseline schedule.

3.2 Prior to the Work

The Contractor shall carry out all necessary surveying work required for the approved performance of the work and shall ensure that the position and elevation of all works thus constructed are correct. The measuring methods and devices used must meet the standard of accuracy required for this purpose.

3.3 Access Works (Matale site)

The construction and maintenance of permanent and temporary access roads or access ramps from public roads to the sites, including crossings, shall be the Contractor’s responsibility to the approval of the Engineer.

In general, all roads within the site area shall be the Contractor responsibility, construction and maintenance, during the work until final handover to the Engineer.

Proper maintenance of all roads being used by the Contractors during the entire construction period, both permanent existing ones as well as temporary roads, shall be the Contractor’s responsibility.

Additional roads and ramps which have to be built to transport equipment and materials shall be constructed by the Contractor at his own expense and with the Engineer’s prior approval,

and the maintenance of such roads during the construction period shall also be at the Contractor's expense. The same applies for existing public roads and bridges used by the Contractor in the vicinity of the site for the execution of the work.

Any work, improvement or modification at the existing access roads made by the Contractor, for his own convenience, and without being ordered by the Engineer, shall be at the Contractor's own risk and expense.

If any damage or pollution occurs during the execution of the work, the Contractor must restore and clean the roads immediately at his own cost.

After completion of the Contract and before delivering the work to the Engineer (final takeover), all temporary structures shall be removed to the satisfaction of the Engineer.

3.4 Construction Facilities

3.4.1 Stores, warehouse, workshops and material yards

The Contractor shall provide and equip, for his own and his Subcontractors' use, warehouses, materials storage areas and fuel storage areas, all of which shall be maintained in good condition until the completion of works.

Listed hereunder are the buildings, workshops and warehouses expected to be constructed and equipped by the Contractor for use in the performance of the work under this Contract, in addition to facilities explicitly specified elsewhere in these specifications:

A Workshop and service facilities for vehicles and construction equipment

B Main warehouse and parts store

C Storage facilities for all materials applied within the conduction of the rehabilitation works

3.4.3 Materials testing laboratory

The Contractor shall build and equip an adequate field laboratory for the sampling and for testing of all materials as specified in the pertinent sections of the specifications.

The laboratory shall be located in a building properly equipped with electricity, water, air-conditioning/heating, etc., and shall have enough room for storing the samples tested as required by the Engineer.

The equipment to be supplied and the methods of testing shall be in accordance with the relevant codes and standards and as approved by the Engineer. All apparatus and equipment shall be in good working conditions, functional and manufactured by a reputable manufacturer.

The Contractor shall operate and maintain the laboratory until the Completion of Works and make all facilities and services available to the Engineer as required. All sampling and testing to be undertaken shall be under the direct supervision of the Engineer. The laboratory shall be run by Contractor's personnel experienced in sampling and testing of materials, and quality control.

Specialised testing which may be required and which cannot be performed in the Contractor's laboratory due to lack of time or equipment shall be assigned to an independent organisation approved by the Engineer. The Contractor shall accept all results, instructions or restrictions stipulated by the Engineer in writing based on such tests.

Upon completion of the work, all laboratory equipment shall remain the property of the Contractor. However, the Engineer reserves the right to purchase some or all of the equipment by mutual agreement.

3.4.4 Construction equipment

The Contractor shall provide suitable and adequate temporary construction equipment until the completion of the work under this Contract.

A schedule including a list of quantities for temporary construction equipment has to be delivered to the Engineer on a monthly basis for information.

Full costs of all construction equipment shall be included under the unit prices of each part of the Work.

3.5 Utilities

3.5.1 Power supply and illumination

The Contractor shall supply, install, operate and maintain an adequate power supply system and illumination for running the site and other site installation facilities during the whole construction period. The concept shall be approved by the Engineer.

3.5.2 Water supply

The Contractor shall provide, install, operate and maintain adequate and suitable water supplies for the work within the contract including storage for drinking purposes, sanitation, construction, cleaning, testing and commissioning of the various equipment items and plant components of the construction lot.

The water supplies shall be continuously available during working hours and rated to meet the maximum demand required during construction on the basis of 'firm supply' and shall supply all temporary installations.
The drinking water provided shall at all times meet the criteria of the local health authority.
The concept shall be approved by the Engineer.

3.5.3 Sanitation, sewerage and waste disposal

The installations shall meet the requirements of the local health authorities and environmental regulation.
The Contractor shall collect waste material and garbage from site on a daily basis and transport it to an approved area where it shall be treated and disposed of in accordance with local environmental requirements.
The Site shall be kept clean and free of refuse at all times. No waste shall be dumped in areas other than those approved by the Engineer for waste disposal. No waste of any kind shall be deposited in any water courses.

3.5.4 Communication systems

The Contractor shall supply, install, operate and maintain a complete telephone system satisfying all his needs and the needs of the Engineer at site including external lines to the public switched telephone network and external connection to an internet access provider.

3.5.5 Office space

The Contractor shall supply, construct, equip and maintain an office for the sole and exclusive use of the Engineer, fully furnished and equipped with facilities and services.
The office building shall be provided with the necessary portable fire extinguishers and service facilities necessary for normal and comfortable occupation by 6 people. The building shall be air-conditioned.
The offices shall be equipped with adequate furniture (desk, chair etc.) and fittings (electricity, lights, toilets, water etc.) for use as an office. Furthermore the office shall be equipped with an Internet connection.
The offices shall be maintained by the Contractor at his expense.

3.6 Site security

The Contractor shall employ an adequate force of trained security guards at the work site and at the construction camp on 24-hour duty including weekends and holidays.

3.7 Demobilisation

Upon the completion of works the Contractor shall reinstate the site and dismantle and demobilize all temporary facilities erected by himself or his Subcontractors, and remove all debris, objectionable material and all other refuse which may have been deposited on site during the construction period. Such materials may be deposited only in areas approved by the Engineer.

All excavated areas shall be filled, graded and dressed in a clean and orderly condition acceptable to the Engineer. As far as possible such areas should conform to the natural appearance of the landscape.

3.8 Environmental obligations

The Contractor shall, during the whole period of the work comply fully with all national Sri Lankan laws and regulations relating to environmental protection, mitigating measures for reducing environmental impacts and remedial works on completion of the Work. This obligation shall extend to the construction sites themselves and all of the Contractor's site installations.

Notwithstanding any specific obligations as these may be specified in prevailing Sri Lankan laws and regulations, the Contractor shall at all times comply with the following particular requirements for the protection of the environment, the local population and the workers at the construction site:

- Collect, treat, remove from site and dispose of in accordance with the regulations and to the satisfaction of the Engineer all domestic and industrial waste and excess construction materials (both solid and liquid), fuel, chemicals and other matter.
- Make every effort to minimise the harmful effects of transport to and from the site, in particular vehicle emissions and noise and the control of dust on roads.

The Contractor shall maintain close contact with local representatives and government institutions in addressing issues arising from the construction activities. Such issues needing particular attention are the following.

- Pollution caused by the Work
- Disruption to the local community
- Disputes related to the use of land for construction activities and/or site installations etc.

- Disputes arising from traffic congestion and restrictions on the use of the main project access road and roads in the project area
- All matters relating to road safety and the reduction to a minimum of the risk of traffic accidents.

3.9 Social obligations

As far as may be reasonably practicable, the Contractor shall recruit his unskilled labour from those persons from the local community who may apply for work. Suitably skilled workers in the local community should also be recruited wherever practicable.

4 SAFETY AND HEALTH PRECAUTIONS

4.1 General

This section covers the precautions that have to be taken for the health and safety of all personnel on Site that the Contractor and his Sub-Contractors shall apply in all civil construction and equipment erection works during the construction time.

The Contractor shall provid all necessary safety measures to workmen at site confirming to the latest industrial safety regulations and “The Guidance for the Management of Safety for Construction Works in Japanese ODA Projects” prepared by JICA and as directed by the engineer. In the Guidances, two plans for the safety management for the work sites shall be prepared and implemented by the Contractor, namely the "Safety Plan" and "Method Statements on Safety." The Contractor shall prepare the Safety Plan in the Bidding stage and Method Statements on Safety in the construction stage.

4.2 Safety precautions

4.2.1 Safety programme and its implementation

A safety program shall detail policies, procedures, and plans which the Contractor intends implementing to ensure the safety and health of his employees. It shall comply with the standards and regulations in force in the country of the Work applicable to construction safety.

The Contractor shall designate a competent employee specially trained and experienced to act as Safety Officer, who will administer and be responsible for the implementation of the safety program. He shall carry out frequent and regular safety inspections of the working areas, materials, and equipment. The name and qualifications of the Safety Officer shall be submitted for approval to the Engineer prior to his appointment.

The Contractor shall be responsible for the implementation of health and safety provisions for his subcontractors employed at Site.
All serious and fatal injuries and diseases caused by the progress of work shall be immediately investigated by the Contractor and a comprehensive report shall be submitted to the Engineer.
In case of a fatal accident, only rescue and emergency teams and operations shall be permitted at the place of the occurrence until the Engineer gives permission to resume normal operations.

4.2.2 Safety standards

In addition to the requirements of the following specified herein, the Contractor shall comply with all currently applicable safety documents and/or organizations:

4.2.3 Safety of personnel

The Contractor shall be responsible for the safety of all personnel on the Site and shall provide his employees and his sub-contractors employees working on the Site, the Engineer's staff and all visitors to the Site with safety equipment appropriate to the tasks upon which they are engaged, including helmets, high visibility vests or jackets, safety footwear and, where required, gloves, lamps, waterproof clothing, dust masks and/or safety belts. The use of such safety equipment shall be compulsory, as deemed necessary by the Engineer.
During drilling works and in areas where the personnel are exposed to harmful noise levels and dust, ear protectors and masks shall be furnished and required to wear.
Employees engaged in work having an inherent danger of eye or face injury shall be furnished and required to wear protection glasses, goggles or masks. Where irritant or toxic substances may come in contact with the skin or clothing, employees shall be wearing protective clothing or shall be required to apply a protective ointment by a competent physician.
Personnel working on steep slopes or otherwise subject to possible falls from levels not protected by fixed guardrail or safety nets, shall be secured by safety belts and lifelines.
Portable ladders shall be wooden or steel ladders sufficiently strong and with suitable size for the use intended. Wooden ladders shall have the steps fixed to the longitudinal posts by assembly. The use of ladders with steps nailed or wired along the longitudinal posts is not permitted.

4.2.4 Security of personnel and working areas

The Contractor shall take at all times the necessary measures to ensure the safety and security of all persons, work and property. This shall include but not be limited to the following:

- Access control to all areas related to the Work
- Installation of fences
- Security patrols

4.2.5 Maintenance of traffic and safety on roads

The Contractor shall be responsible for the safety on the roads related to the Site. He shall take all necessary precautions for the protection of the work and the safety of the public on the roads affected by his activities. Where the work will be carried out at the site of, or close to an existing road, the Contractor shall maintain the vehicular and pedestrian traffic safe at all times. If his operations can cause traffic hazards, he shall repair or fence or take other measures for ensuring safety which are satisfactory to the Engineer.

Roads subjected to interference with the work shall be kept open or suitable detours shall be provided and maintained by the Contractor, who shall provide, erect, and maintain all necessary barricades, suitable and sufficient flashlights, flagmen, danger signals, and signs.

Roads which will be closed to traffic shall be protected by effective barricades on which acceptable warning and detour signs shall be placed. All barricades and all lights shall be kept burning from sunset to sunrise.

The Contractor shall submit his weekly activities schedule and the locations of his work along the existing public roads to the authorities concerned, and obtain all necessary approvals prior to commencement of the respective work.

The Contractor shall provide temporary passes and bridges to give an access to the existing villages, houses, etc., to the satisfaction of the Engineer and the authorities concerned whenever he disturbs such existing ways during the execution of the Work.

4.2.6 Weather precautions

In order that the Work may proceed according to the programme, the Contractor is to undertake at his expense all necessary precautions for protection against inclement weather, which shall be subject to the approval of the Engineer.

4.3 Health precautions

4.3.1 First aid

Prior to the commencement of construction, the Contractor shall organize and train a first aid team composed of his employees. This team shall be capable to render help after accidents.

The first aid team shall be organized in such a way that sufficient number of members will be ready for action at any time until the completion of the Work.

The team members shall be instructed and trained for their task by a qualified and experienced person. Each team member shall be skilled in giving first aid, dealing with the appliances for artificial respiration, and firefighting equipment and shall possess a good local knowledge. Adequate equipment for reaching even the remotest working area shall be at their disposal.
The Contractor shall submit the details of the proposed first aid team organization to the Engineer for approval.

4.3.2 Noise control

The Contractor shall take the provisions required to assure that noise from his construction activities and from the operations of any plants are within the limits established by the WHO for the health of his personnel, or shall provide his personnel with ear protectors. Ear protectors shall be provided to all personnel subject to noise levels above 85 dB on a continuous basis during work shifts.

5 SITE SUPERVISION AND REPORTING

5.1 Site supervision

The Contractor is responsible for providing proper supervision of his site activities by employing suitably qualified and experienced site management and supervisory personnel so that he can carry out his obligations under the Contract.
For the Contractor's information, the Engineer has issued a Construction Supervision Manual, dated August 2010, which is intended for use by the Engineer and his staff for the supervision of the Work. This manual includes standard forms which will be used during construction for control of the work. It is available to view in the office of the Engineer.

5.2 Monthly progress report

Before the tenth day of each month, the Contractor shall submit three copies of a monthly progress report in a form acceptable to the Engineer detailing the progress during the preceding month. The monthly progress report shall show the amount of work completed, materials actually used, materials in storage and the cumulative results of all operations completed or in progress and shall be summarized in terms of percentage of completion referenced to the agreed programme for the work.

The monthly progress report shall include at least the following:

- Total percentage of work completed and total percentage programmed to be completed by the end of the reporting period;

- Actual percentage of each main work item completed as well as their scheduled percentage, both total and for the reporting period together with the estimated quantities;
- List of manpower by trade and foreign personnel by position for the reporting period;
- List of equipment and operational days for the reporting period and materials on site at the end of the period;
- Description of weather conditions for the period including records of each rainfall duration and recorded river water levels (if any);
- List of any accident except of minor nature and any damage that occurred;
- Any matter which affected or may affect the progress of the work, problems encountered and proposed remedial measures;
- Colour photographs with imprinted date, not smaller than 100 mm by 150 mm of the work progress during the period for all major components of the Work. The Contractor shall also provide digital versions as well as 5 sets of hard copies of these photographs in albums with titles.

Further the Contractor shall submit financial statements, purchasing and expediting reports, shipping reports, and any other data which the Engineer may reasonably ask for.

Additional to the photographs included in the progress reports, the Contractor shall arrange for the taking of progress colour photographs every month, covering all aspects of the Work. Two copies of such photographs, suitably dated and captioned, shall be submitted to the Engineer, plus a CD with all relevant files.

5.3 Quarterly progress report

Before the tenth day of March, June, September and December, the Contractor shall submit three (3) copies of a quarterly progress report in an acceptable form to the Engineer detailing the progress.

The quarterly progress report shall show the amount of work completed, materials actually used, materials in storage, and the cumulative results of all operations completed or in progress, and shall be summarized in terms of percentage of completion referenced to the agreed programme for the work.

Upon receipt of the quartely progress report, the Engineer will issue the certificate of progress of works after careful checking.

5.4 Final report

The Contractor shall submit the final report not later than one month after completion of the Work. This report shall include all relevant information related to the Work in a format approved by the Engineer. The Contractor shall submit to the Engineer one copy of the draft report. The final report shall be submitted in triplicate. The final report shall also be made available electronically in pdf format or alternative approved format. The submission of the final report shall follow within one week of acceptance of the draft report.

6 DESIGN DOCUMENTS AND CONSTRUCTION DRAWINGS

The Contractor shall ensure that design work is only allocated to personnel with adequate qualifications and relevant experience to perform the required tasks. Based on the Bidding drawings assigned design engineers shall develop designs and prepare associated design documents and construction drawings to be approved by the Engineer.

The Contractor will be responsible for the control of the design activities performed as well as their verification. The Contractor shall control and document any revised information in the same manner as drawings and specifications, to assure correct communication through the design interfaces.

7 PREPARATION OF AS-BUILT DRAWINGS

During the construction and commissioning period any variations between the "Construction Drawings" and the "As-built Drawings" shall be agreed between the Contractor and Engineer at site.

All agreed modifications will be marked up by the Contractor's draughtsman and included on the originals at site. A complete set of these mark ups shall remain at site. The Contractor shall allow for the provision of a draughtsman as required at site to co-ordinate and include all modifications on the drawings. The originals shall then be returned to the Contractor's head office and these shall form the basis of the “As-built Drawings”.

The Contractor shall submit to the Engineer all final revisions of all original drawings depicting the “As-built” situation for the work. All drawings and documents prepared exclusively for the project shall become the property of the Engineer.

Final drawing prints shall be size A1 or smaller. Reproducible of the final drawings shall be supplied as follows:

- 2 prints of each drawing to the Engineer.
- 2 CDs with original AutoCAD drawing files to the Engineer

Where drawings are reduced, an appropriate scale shall be included on the reduced print. To accompany the drawings, the Contractor shall provide a Master Schedule of “As Built” drawings.

Section 7
SPECIFICATION FOR EARTHWORK

1 SURFACE EXCAVATION AND EMBANKMENT

1.1. Scope of work

This section covers all surface excavation work to be performed under this Contract, which shall consist of removing all existing material of whatever nature to the lines and grades shown on the drawings or as otherwise directed by the Engineer in writing. This work shall include excavating, ripping, loading, hauling, double handling and disposal of materials in designated spoil or stockpile areas, according to these Specifications.

This section also covers all embankment work to be performed under this Contract, which shall consist of soil laying and levelling and soil compaction using excavate-reusing soil, generated soil, collected soil and purchased soil.

1.2. Submittals

Prior to the commencement of any surface excavation and embankment, the Contractor shall submit in writing to the Engineer details of the proposed excavation and embankment methods and sequences, including necessary safety precautions.

Prior to dumping or stockpiling any material, the Contractor shall submit in writing the layout of spoil or stockpile areas to the Engineer and wait the approval in writing. All pertinent data of working methods and provisions for the security, stability and temporary and permanent drainage of the areas shall be included by the Contractor. Details of volumes, material types, heights and grades shall be provided.

1.3. Lines and grades

The final excavation grades shall in general be rock of specified quality. However, where the final excavation grades are defined by line and grade, the Contractor shall take every precaution and use the most appropriate method of excavation, to avoid the loosening of material or the breaking of rock beyond the lines and grades shown on the drawings. Loose weathered rock shall be removed.

The bottoms of all excavations shall be trimmed to line and grade to the satisfaction of the Engineer.

If, for any reason, excavation is carried out beyond the lines and grades shown on the drawings, the Contractor shall remove the excess material and take the necessary measures to restore the required lines and grades with approved backfill or concrete, at his own expense.

Should the Contractor wish to excavate beyond the limits given on the drawings for his own convenience, he may do so, at his own expense but only with the prior written approval of the Engineer.

1.4. Clearing and grubbing

Clearing means the removal, transport and appropriate disposal of all trees, brush, stumps, fences, existing structures, spoil, debris and other obstructions in the areas to be occupied by the Work, surfaces of borrow and quarry areas, spoil and stockpile areas, and where interfering with the procedure or functioning of the work.

Grubbing means the removal, transport and disposal of all roots, buried logs, foundations of structures (except concrete or masonry in mortar) and other materials foreign to the natural topsoil in the areas to be occupied by the Work and surfaces of borrow and quarry areas.

Clearing and grubbing work shall be performed either manually or with mechanical equipment. The Contractor shall make every reasonable effort to salvage such material which may be put to beneficial use.

All materials from clearing and grubbing work shall remain the Employer's property but the Contractor may, subject to written approval from the Engineer, retain any material for his use. Materials which the Contractor does not wish to use shall be disposed of in an approved manner.

Materials to be burnt shall be piled neatly in such a manner and in such locations as to not cause any fire risk and shall be burnt completely so that all material is reduced to ashes.

The Contractor shall have suitable equipment and supplies for fighting fire during the burning of material and shall take all necessary precautions to prevent fire from spreading. Toxic materials such as tyres etc. shall not be burnt but disposed of in the approved manner.

1.5. Excavated materials

All suitable materials from the excavations shall be utilised to the fullest extent practicable as construction materials in the Work, subject to the written approval of the Engineer.

The Contractor's excavating techniques shall be such, that as much as practicable, construction materials will be yielded.

The suitable material shall be stockpiled. If the moisture content of excavated materials suitable for embankments or backfill is too high after excavation, the material shall be drained and dried in the stockpile until the moisture content is sufficiently reduced to allow placement, or vice versa moistened if too dry.

1.6. Disposal of excavated materials

Excavated material which is not suitable for, or are in excess of the construction requirements shall be disposed of in the spoil area as directed or approved by the Engineer.

The spoil tips shall be located where they will not interfere with the natural flow of streams or rivers or other works. No rock material may be dumped into the river bed.

The Contractor shall shape and trim the stockpiles to the lines and grades as directed. Adequate diversion of water courses in such areas and proper drainage shall be provided as proposed by the Contractor and approved by the Engineer. The Contractor shall be liable for any damage to the work or to the property of third parties caused by poor drainage in the spoil or stockpile areas.

1.7. Preparation and protection of excavation and embankment surfaces

Excavation and embankment surfaces against or upon which concrete, embankment fill, or backfill will be placed shall be prepared and protected as specified herein and in combination with specifications contained in the pertinent sections of these specifications or as shown on the drawings.

If, during excavation work, materials beyond the limits of excavation shown on the drawings are loosened or disturbed, the Contractor shall re-compact the loosened material or remove it altogether and replace it with other compacted fill or concrete as directed.

Foundation excavation shall be kept well drained and free of standing water. The Contractor shall provide all necessary drains, ditches and sumps and use pumps when necessary to ensure that foundation surfaces are not harmed by water. When foundations are thus affected, the affected material shall be removed and replaced with approved backfill.

Any support to be applied to the finished excavation surfaces where it is deemed necessary shall be carried out by the Contractor and approved by the Engineer.

1.8. Specification for field compaction

Performance based specification should be practiced for embankment.

Field compaction equipment utilized for compaction shall be a suitable vibrator depending on the available soil type.

The fill material should be free from clay lumps.

Fill material shall be placed in layers not exceeding 250mm thickness in loose state. The fill shall be compacted at each lift not less than 92% of the modified Procter density (ASTM D1557). If sizes of materials are more than biggest allowable limits, the Contractor shall

conduct tampering more than three times in each layer or appropriate compaction method shall be proposed by the Contractor and approved by the Engineer.

The earth fill shall be compacted at or near the optimum moisture content.

The moisture content of the material shall be checked during compaction at a frequency agreed by the Engineer. If the material is too wet, it shall be dried by aeration and if it is too dry the material shall be sufficiently wetted prior to the compaction.

Each successive layer shall be placed only after the degree of compaction of the previous layer has been tested and found satisfactory as specified.

In situ compacted unit weight should be determined by the sand cone test or core cutter test.

- For the earth embankment, refer the document of ICTAD 2009; Specifications for Construction and Maintenance of Roads and Bridges, clause 300.
- For the rubble dressing on the embankment, refer the ICTAD publication No.SCA/3/1 on Irrigation and Land Drainage Work, chapter 6

Section 8
SPECIFICATION FOR SURFACE DRAINAGE DITCH

1 EXCAVATION

1.1 Excavation for Structures

The work shall consist of the necessary excavation for foundation of any structure, culverts, retaining walls, lined drains and other structures. The work shall include upholding sides of excavation, additional excavation to provide working space and removal of dead services.

The work shall include preparation and trimming of the excavated surface and additional difficulties occurring excavation below ground water level, backfilling and disposal of excavated material.

The excavation shall deem to be carried upon material other than unsuitable soil, rock or artificial hard material.

1.2 Extra over for rock excavation（If necessary）

This item measured extra over to item 1.2. The item includes all kinds of rock including hard rock and soft rock excavation. The excavation includes rock excavation other than use pneumatic tools or drilling and blasting operation. The item includes weathered rock, stand stone, limestone and such materials which in opinion of engineer, can be excavated by picking, ripping or other similar means without resorting to blasting.

Item includes disposal of excavated material as directed by the engineer.

2.0 Concrete Drains

2.1 Surface drainage ditch

All concrete works include formwork and other ancillary work and shall be covered by relevant specification. The work shall include supply, proportionate and mixing of all materials; transporting, placing and compaction, finishing and protecting and curing for specific periods. The work shall be carried out in accordance with specification and with the lines, grades and dimensions shown in the drawings and instructed by Engineer.

Casting, curing and testing of concrete cubes shall be carried out as given in BS 1881 Part 108 of 1983.

The material shall be tested in accordance with these specifications and shall meet the prescribed standard of acceptance.

The work shall confirm to these Specifications and shall meet the prescribed standard of acceptance.

All reinforcement work shall consist of furnishing, fabricating and placing of reinforcement of the specified grade and type in concrete structures in accordance with specification.

The rate shall include protection & storage and make reinforcement to clean and free from loose rust and mill scale, dirt, oil, grease and paint at the time of fixing in position and subsequently concreting.
Rate to include cutting and bending, confirmed to requirement.
Rate to include Placing and Fixing of Reinforcement, testing to confirm standards
Rate to include all tying wires, spaces, chairs, laps, welded, sewage or screwed sleeve joints and other special joints.
The work for drains shall include compacting bottom of excavation, all levelling and other works
The work shall include all necessary formwork including to formwork where necessary.
The work for drains shall include expansion joints.

If necessary

2.2 Connecting to existing drains and necessary improvement for existing drains

This include connecting new drains to existing drains to complete the drainage system and any additional improvement to meet the requirement of the drainage system including enlargement of existing drains, repair and renovation to existing drain as instructed by Engineer.

Refer the same ICTAD document of 2009 version which was mentioned before clause 700 on Drainage Construction.(Construction & maintenance of roads & bridges)

3 OTHER STRUCTURES

The work includes construction of access road as per the drawings. The work shall consist of construction of un reinforced, jointed plain cement concrete pavement in accordance with the requirements of specification and in conformity with lines, grades and cross sections shown in the drawings or as directed by the engineer. The material shall confirm to relevant specifications.
All concrete works include formwork and other ancillary work and shall be covered by relevant specification. The work shall include supply, proportionate and mixing of all materials; transporting, placing and compaction, finishing and protecting and curing for specific periods. The work shall be carried out in accordance with specification and with the lines, grades and dimensions shown in the drawings and instructed by Engineer.
Casting, curing and testing of concrete cubes shall be carried out as given in BS 1881 Part 108 of 1983.
The material shall be tested in accordance with these specifications and shall meet the prescribed standard of acceptance.
The work shall confirm to these Specifications and shall meet the prescribed standard of acceptance.

The work includes preparation of sub grade or existing ground and proper levelling to receive the concrete work. Concrete work shall include polyphone.

Provision shall be made for contraction, expansion and longitudinal drawings as directed by engineer.

Rate to include all construction joints.

Section 9
SPECIFICATION FOR HORIZONTAL DRAINAGE DRILLING

1 GENERAL

Long length horizontal drainage drilling of specified length shall be provided in a fixed space on the landslide slope as drawing. The Engineer may direct the placement of horizontal drainage at particular locations.

Each borehole are drilled using the rotary percussion type drilling machine. The upper angle of each borehole are set 5(five) degrees.

Long horizontal drainage drilling of specified length shall be installed at specified locations. The drains should be of dia.90mm external diameter PVC pipes (Type 1000) perforated on the surface of each pipe on the upper half (perforated dia.6mm with 100 mm centers with 4 rows of holes on upper half) and wrapped with an approved type of geotextile. Inner end of the PVC pipe shall be closed with an end cap. Geotextile used shall comply with general filter requirements.

Each pipe are connected by joint pipe to keep the designed length of horizontal drainage drilling.

The outlet of each borehole is connected with a pipe and drains groundwater into the surface drainage ditch. The outlet of the pipe is protected with a gabion box for protection.

SECTION 10
GABION BOX

The quality of the mesh used should confirm to BS443 for Zink coating &BS 1052 for Tensile Strength

Mesh size of the Gabion box should be 80mmX100mm.

Mesh wire should be in core wire exceeding 2.5mm in diameter and coated wire exceeding 3.5mm in diameter.

Selvedge wire should be in core wire exceeding 3.0mm in diameter and coated wire exceeding 4.0mm in diameter.

Lacing wire should be in core wire exceeding 2.2mm in diameter and coated wire exceeding 3.2mm in diameter.

Diaphragms should be placed at every 1.0m.

Gabion box should be made of high galvanized low carbon steel inter-twisted wire by Triple inter-twisted with machine and forming Hexagonal structure.

Resin film (PVC, PE) used for coating the wires should confirms to ASTM D412, ASTM D 719

The Gabion baskets shall be filled with hard durable crushed stone. This fill shall comprise of 100mm to 150mm well graded stone, it shall be not less than the mesh size (80mm) and not normally greater than 200mm. Filling shall be carried out by hand.

For further details on construction requirements like assembly, installation & filling and also for measurement & payments, refer the following ICTAD document mentioned below;

- ICTAD 2009; Specifications for Construction and Maintenance of Roads and Bridges, clause 805.

SECTION 11

GEOTEXTILE

Refer the ICTAD 2009; Specifications for Construction and Maintenance of Roads and Bridges, clause 1710 and use the Table 1710-2.

VOLUME III

DRAWINGS

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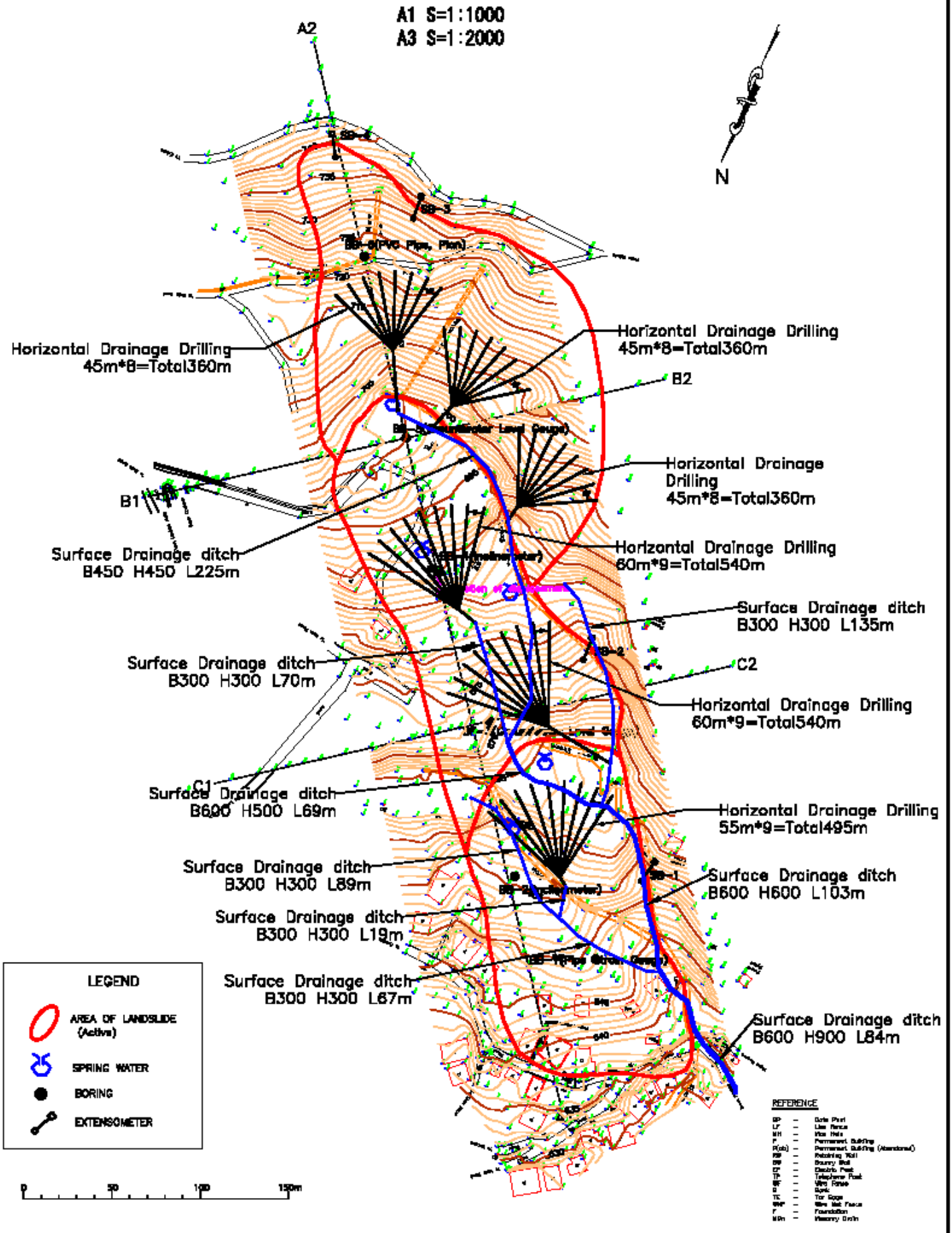
Section 13	**LOT 2. Nuwara Eliya Landslide mitigation works** ·····	**13-1**
Section 14	**LOT 3. Matale Rock fall mitigation works** ·····	**14-1**

Section 12

LOT 1. Badulla Landslide mitigation works

BADULLA LANDSLIDE



CROSS SECTION OF BADULLA LANDSLIDE

Section A1-A2

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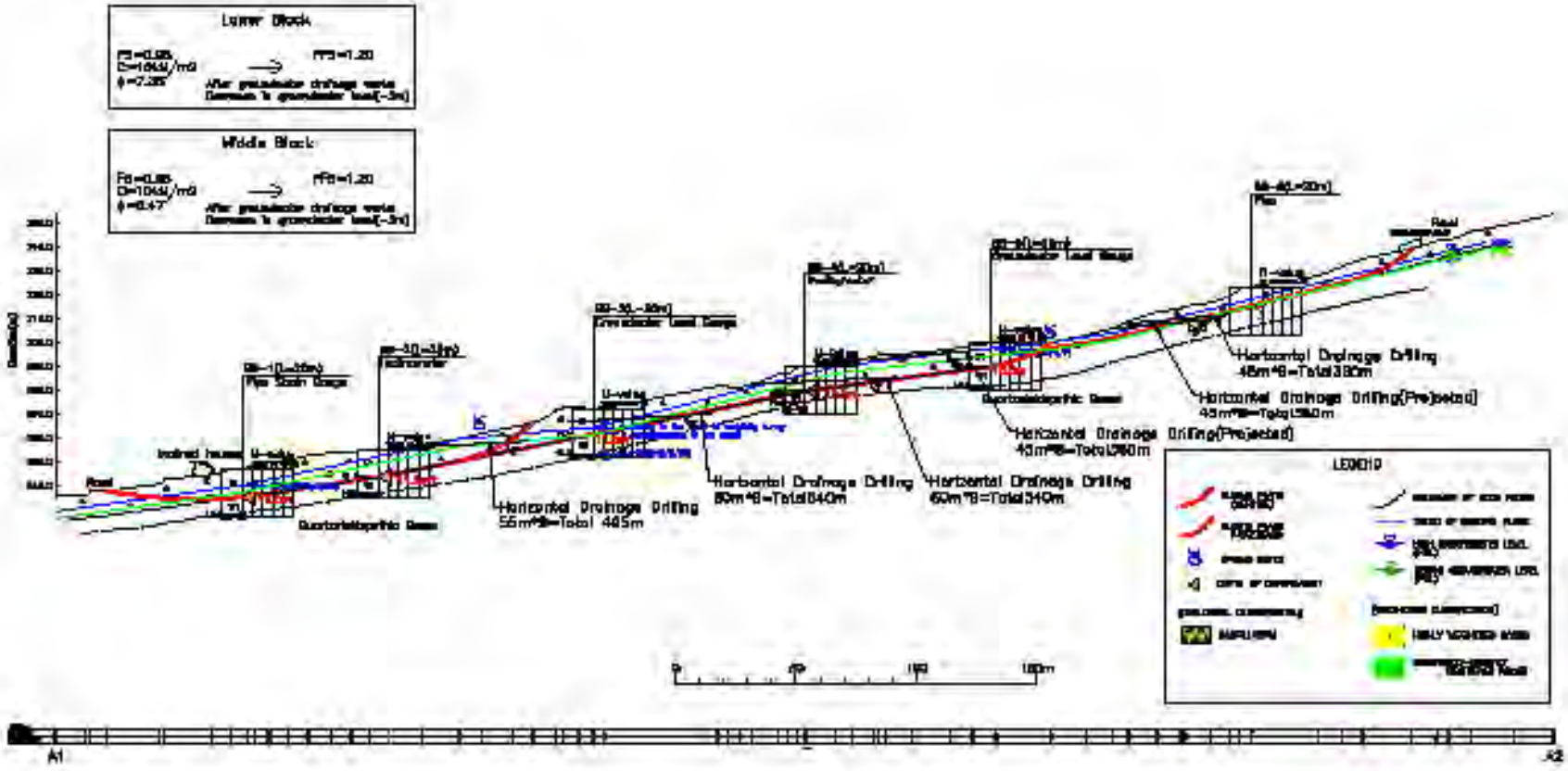
A3 S=1:2000



CROSS SECTION OF BADULLA LANDSLIDE

Section B1-B2

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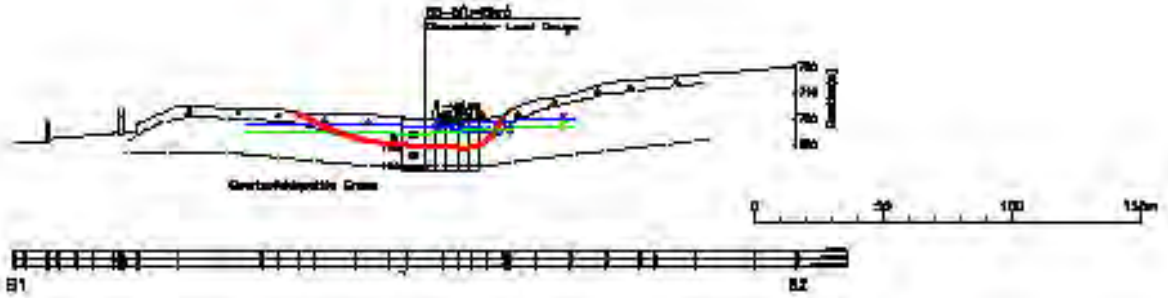
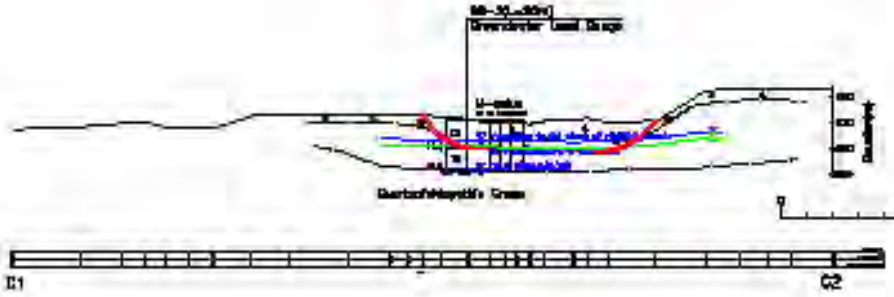
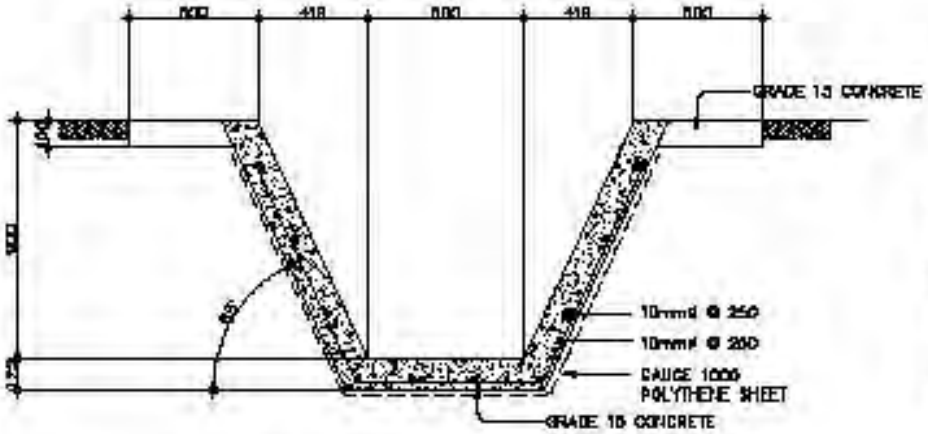
A3 S=1:2000

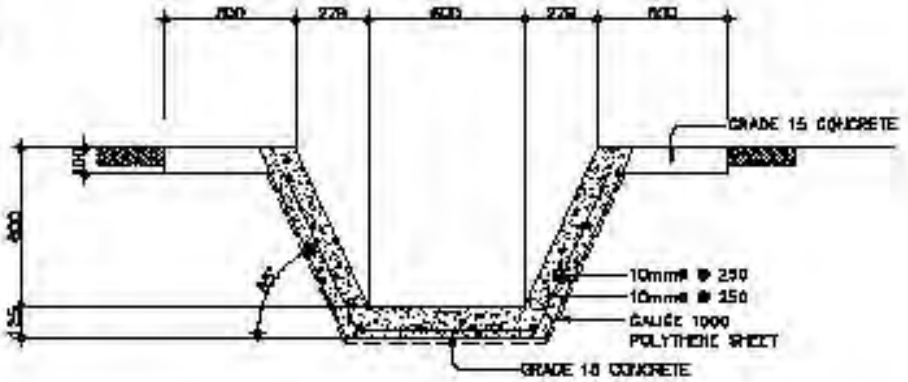


Section C1-C2





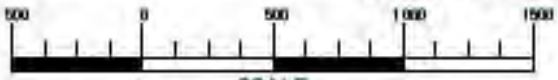
TYPE-A SURFACE DRAINAGE DITCH



TYPE-B SURFACE DRAINAGE DITCH

NOTES

1. ALL DIMENSIONS ARE IN mm.
2. STRUCTURAL CONCRETE TO BE GRADE 25.
3. MINIMUM CLEAR COVER TO R/F TO BE NOT LESS THAN 25mm.
4. REINFORCEMENT NOTATION 'Y' DENOTES LANKA TOR STEEL OF Y(fy=460N/mm2.
5. COMPRESSION LAP LENGTH TO BE 40 x BAR Dia.
6. TENSION LAP LENGTH TO BE 56 x BAR Dia.
7. ANCHORAGE LENGTH SHOULD BE 40 x Bar Dia.
10. HEIGHT OF SIDE WALLS OF THE TRAPIZODIAL CROWN DRAIN WILL BE VARIED ACCORDING TO THE SITE CONDITIONS.
11. DEPTH OF EXCAVATION SHALL BE VARIED ACCORDING TO THE SITE CONDITION.



SCALE

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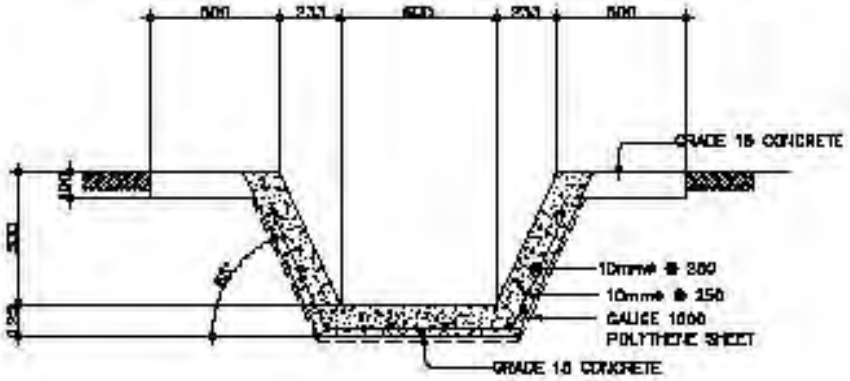
	DATE: 20.07.2015	CHECKED BY:	APPROVED BY:	
BADULLA	DRAWN BY			



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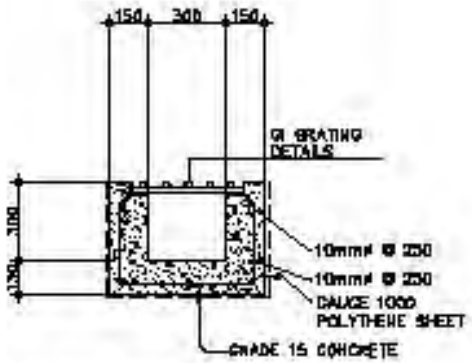

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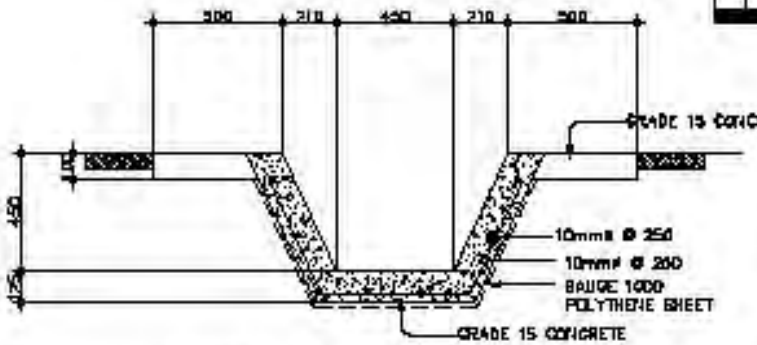
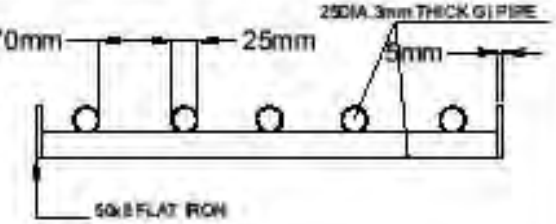


TYPE-D SURFACE DRAINAGE DITCH

SCALE



DETAILS OF THE GRATING

SCALE -1:25

NOTES

1. ALL DIMENSIONS ARE IN mm.
2. STRUCTURAL CONCRETE TO BE GRADE 25.
3. MINIMUM CLEAR COVER TO R/F TO BE NOT LESS THAN 25mm.
4. REINFORCEMENT NOTATION 'Y' DENOTES LANKA TOR STEEL OF Y/S>460N/mm2.
5. COMPRESSION LAP LENGTH TO BE 40 x BAR Dia.
6. TENSION LAP LENGTH TO BE 56 x BAR Dia.
9. ANCHORAGE LENGTH SHOULD BE 40 x Bar Dia.
10. HEIGHT OF SIDE WALLS OF THE TRAPZODIAL CROWN DRAIN WILL BE VARIED ACCORDING TO THE SITE CONDITIONS.
11. DEPTH OF EXCAVATION SHALL BE VARIED ACCORDING TO THE SITE CONDITION.

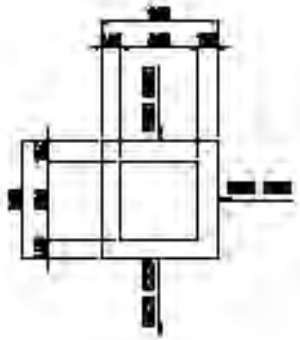
DRAWING TITLE : *DETAILS OF PROPOSED TYPE SURFACE DRAINNAGE DITCH*	DRAWING NO: KN/HO/KCD/TY-DRAIN/DR-01B	DESIGNED BY:	RECOMMENDED BY:	*MINISTRY OF DISASTER MANAGEMENT* *LANDSLIDE RESEARCH &* *RISK MANAGEMENT DIVISION* *NATIONAL BUILDING RESEARCH ORGANISATION* *NO : 99/1, JAWATTA ROAD* *COLOMBO -05* *TEL -011-2589946*
	DATE: 20.07.2015	CHECKED BY:	APPROVED BY:	
BADULLA	DRAWN BY:			

DETAIL FIGURE OF THE WATER COLLECTING PIT

(Badulla)

(600×500×500)

Plan view



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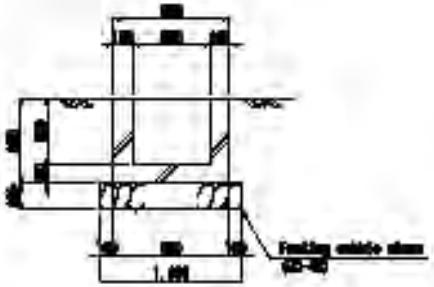
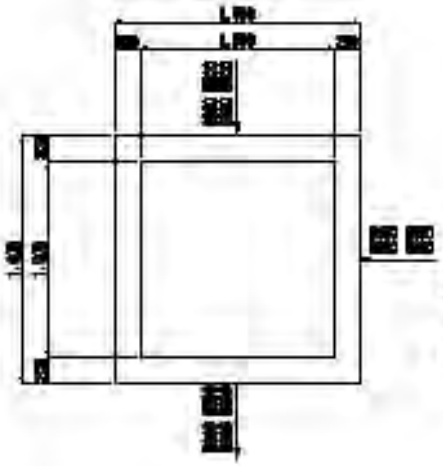


(1,500×1,500×600)

Plan view



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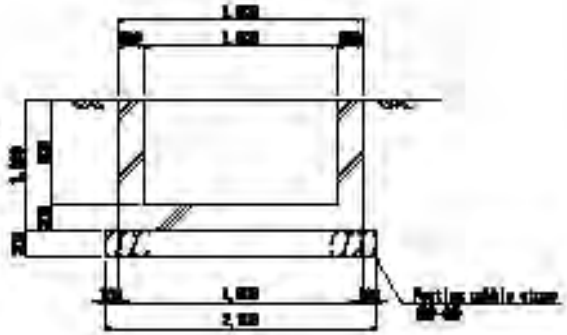
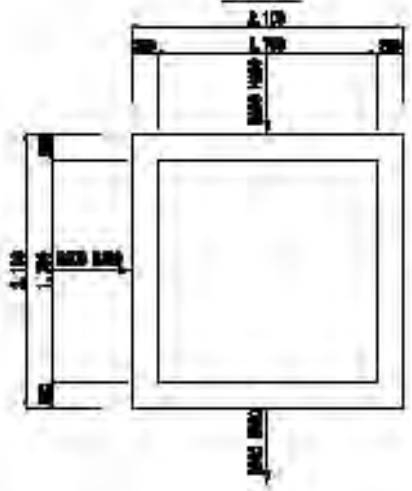
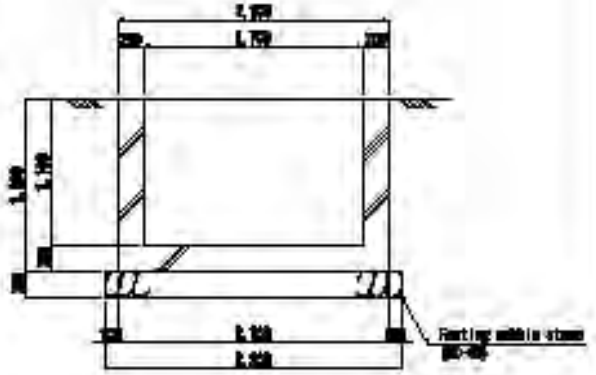


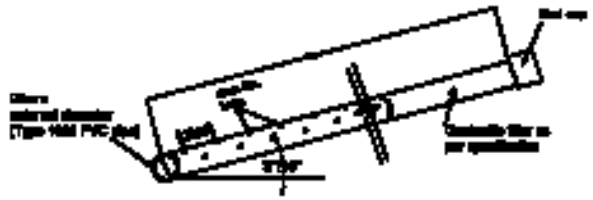
(1,700×1,700×1,100)

Plan view

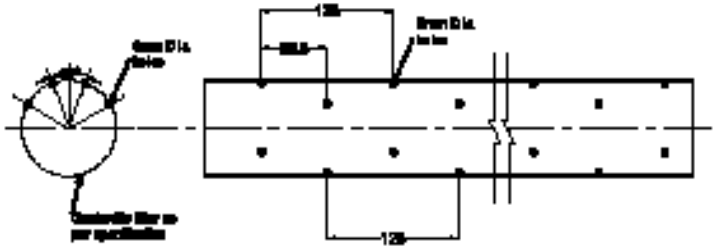


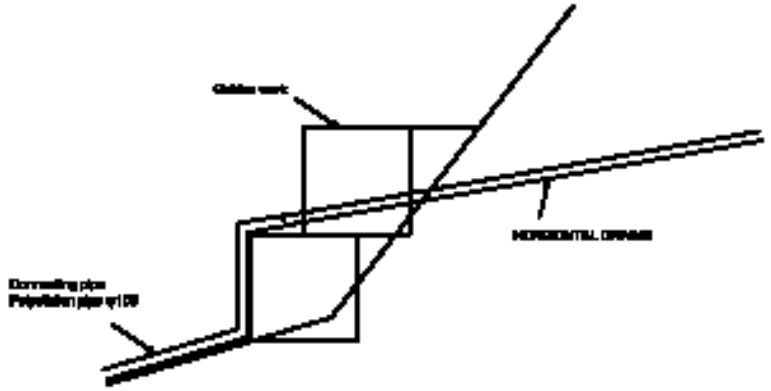
Cross section





DETAILS OF TYPICAL HORIZONTAL LONG LENGTH DRAINS





SCALE

ALL DIMENSIONS ARE IN MILLIMETERS

SCALE

ALL DIMENSIONS ARE IN MILLIMETERS

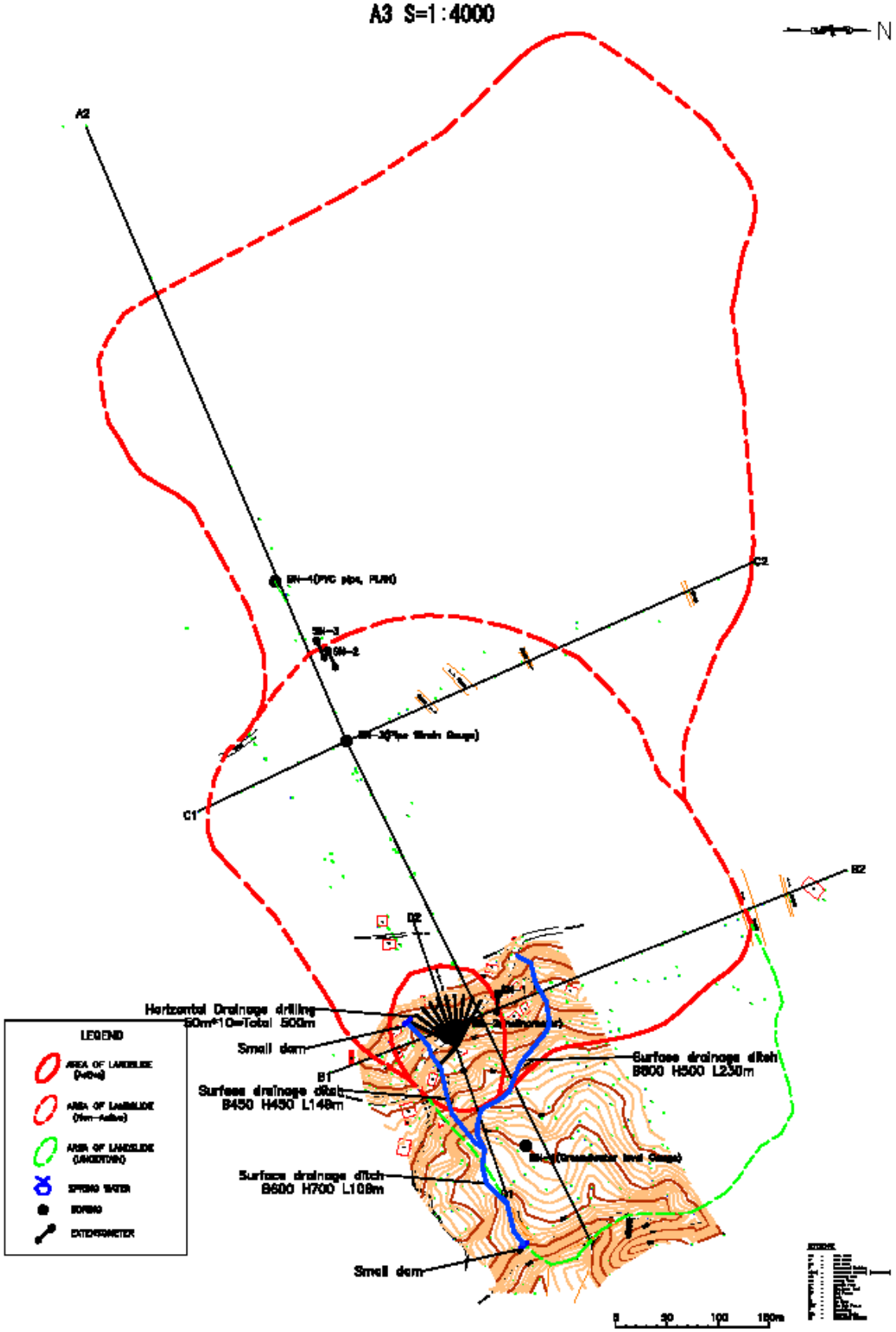
DRAWING TITLE : *DETAILS OF PROPOSED HPRIZONTAL DRAINS*	DRAWING NO: KN/HO/KCDITY-DRAINDR-01A	DESIGNED BY:	RECOMMENDED BY:	*MINISTRY OF DISASTER MANAGEMENT* *LANDSLIDE RESEARCH &* *RISK MANAGEMENT DIVISION* *NATIONAL BUILDING RESEARCH ORGANIZATION* *NO : 99/1, JAWATTA ROAD* *COLOMBO -05* *TEL -011-2555945*
	DATE : 05.10.2016	CHECKED BY:	APPROVED BY:	
BADULLA	DRAWN BY:			

Section 13

LOT 2. Nuwara Eliya Landslide mitigation works

NUWARA ELIYA LANDSLIDE

A1 S=1:2000
A3 S=1:4000



CROSS SECTION OF NUWARA ELIYA LANDSLIDE

Section A1-A2

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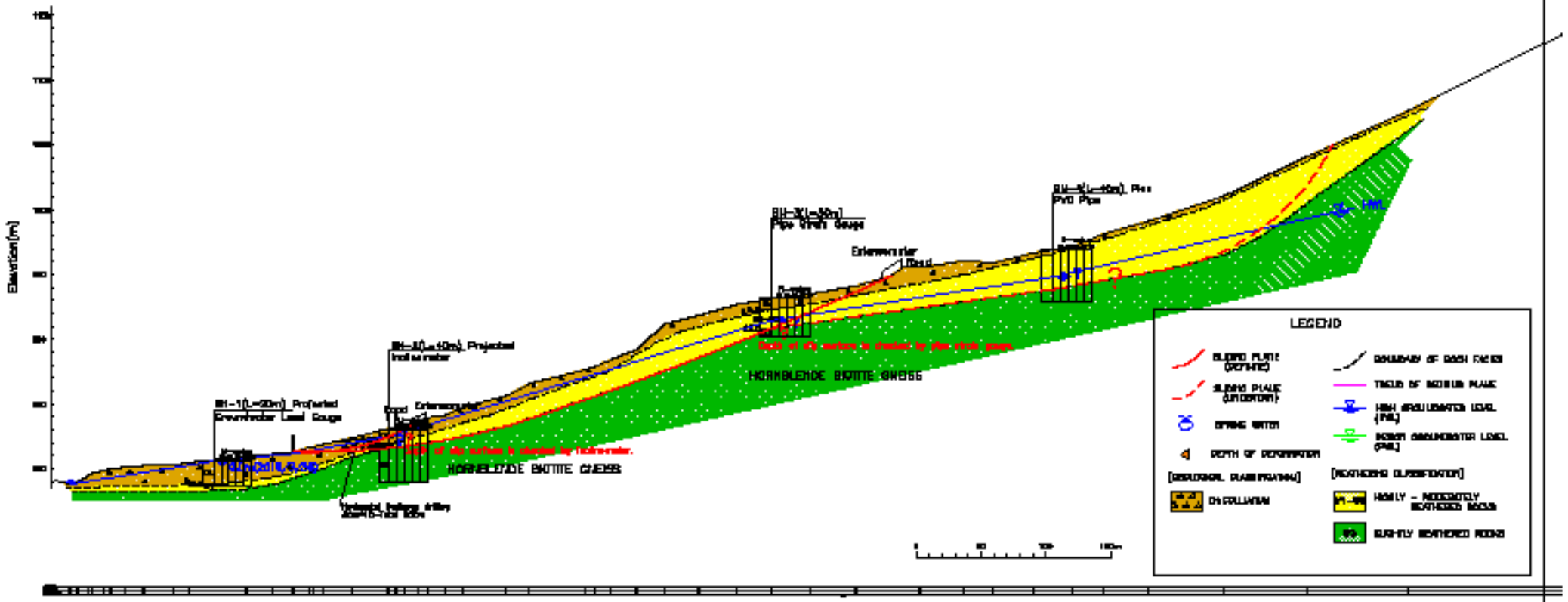
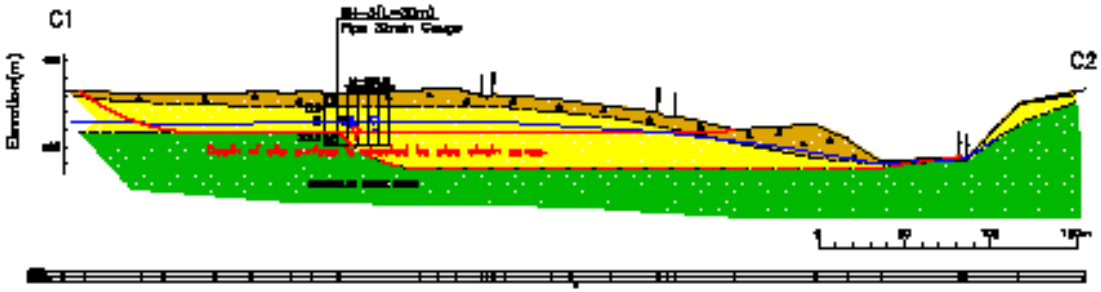
A3 S=1:3000



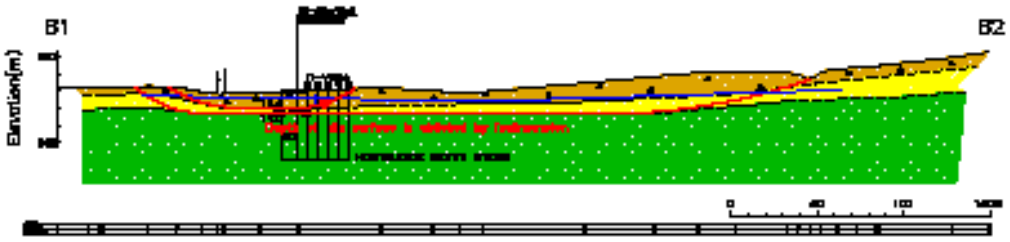
CROSS SECTION OF NUWARA ELIYA LANDSLIDE

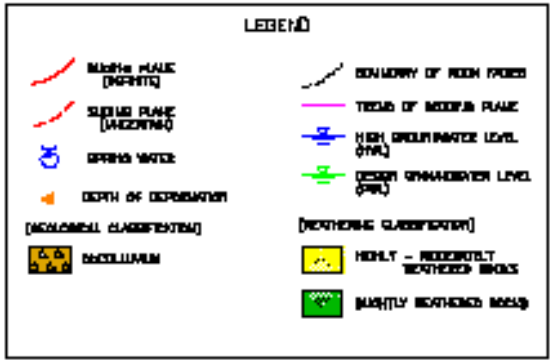
A1 S=1:1500
A3 S=1:3000

Section C1-C2



Section B1-B2





CROSS SECTION OF NUWARA ELIYA LANDSLIDE

Section D1–D2

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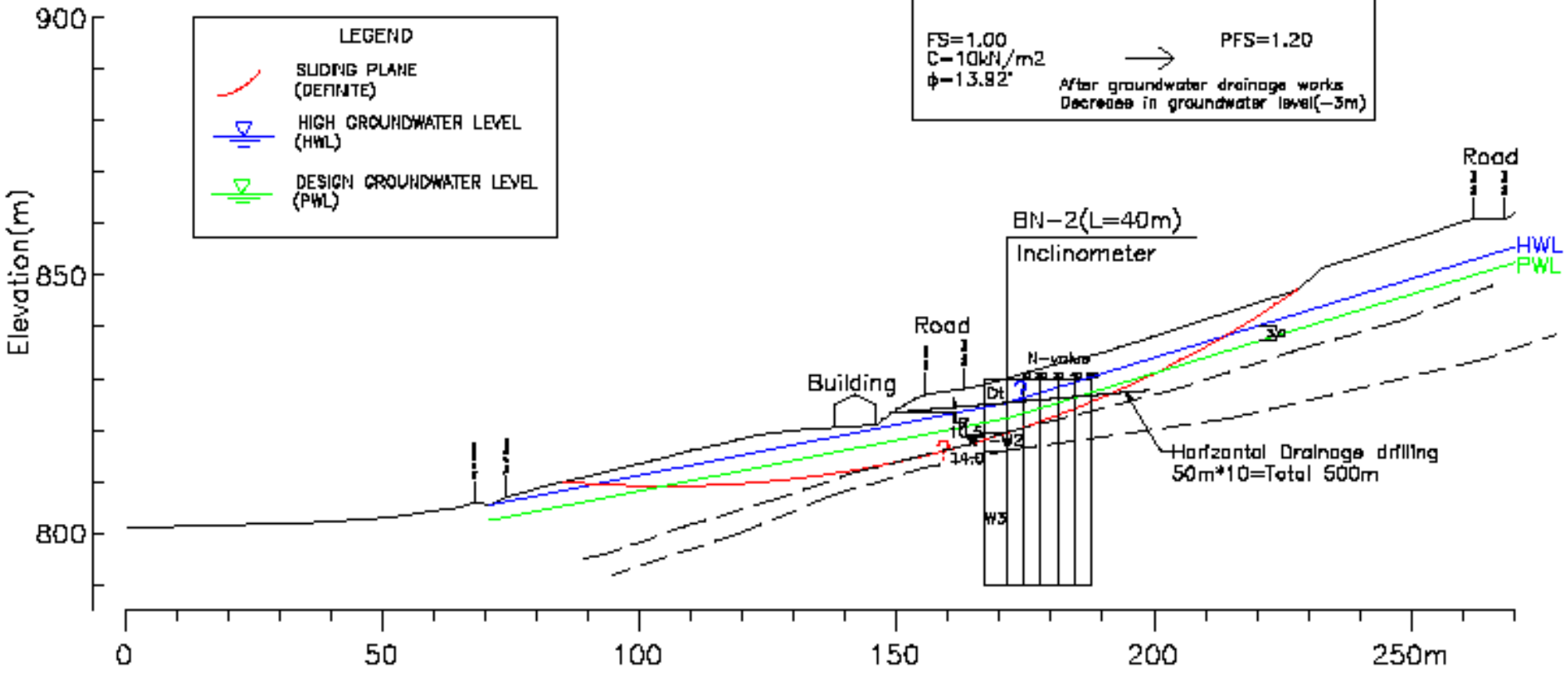
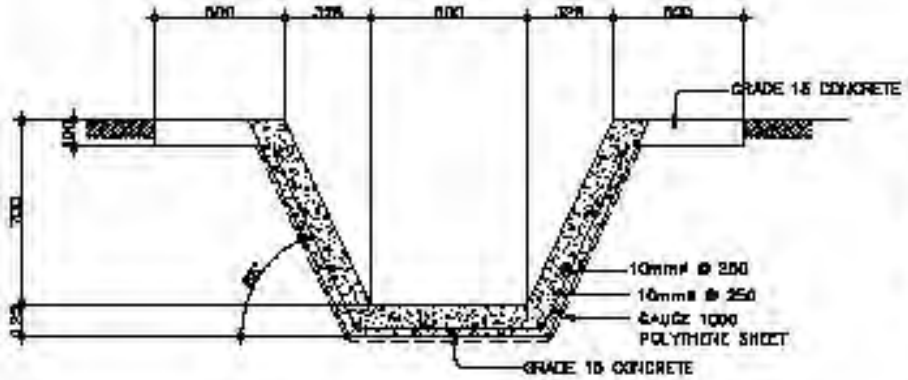
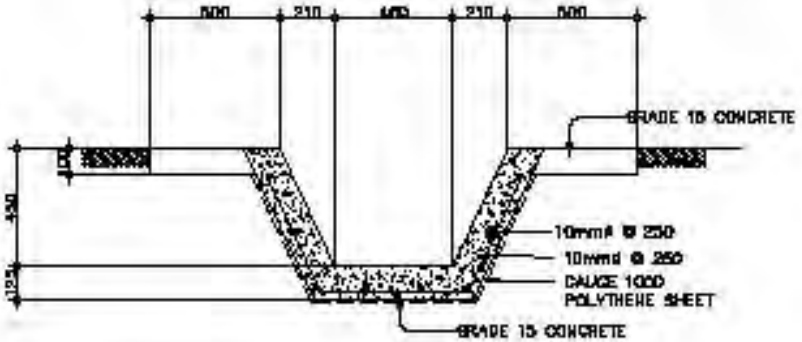
A3 S=1:800

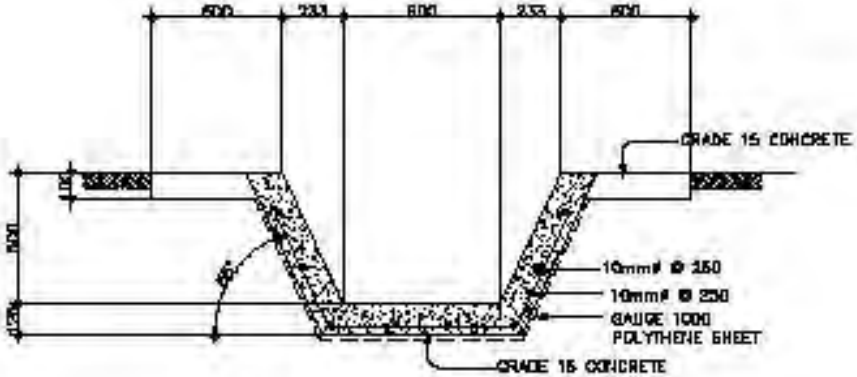




TYPE-A SURFACE DRAINAGE DITCH



TYPE-C SURFACE DRAINAGE DITCH



TYPE-B SURFACE DRAINAGE DITCH

NOTES

1. ALL DIMENSIONS ARE IN mm.
2. STRUCTURAL CONCRETE TO BE GRADE 25.
3. MINIMUM CLEAR COVER TO R/F TO BE NOT LESS THAN 25mm.
4. REINFORCEMENT NOTATION "Y" DENOTES LANKA TOR STEEL OF Y(fy=460N/mm2.
5. COMPRESSION LAP LENGTH TO BE 40 x BAR Dia.
6. TENSION LAP LENGTH TO BE 56 x BAR Dia.
9. ANCHORAGE LENGTH SHOULD BE 40 x Bar Dia.
10. HEIGHT OF SIDE WALLS OF THE TRAPIZODIAL CROWN DRAIN WILL BE VARIED ACCORDING TO THE SITE CONDITIONS.
11. DEPTH OF EXCAVATION SHALL BE VARIED ACCORDING TO THE SITE CONDITION.

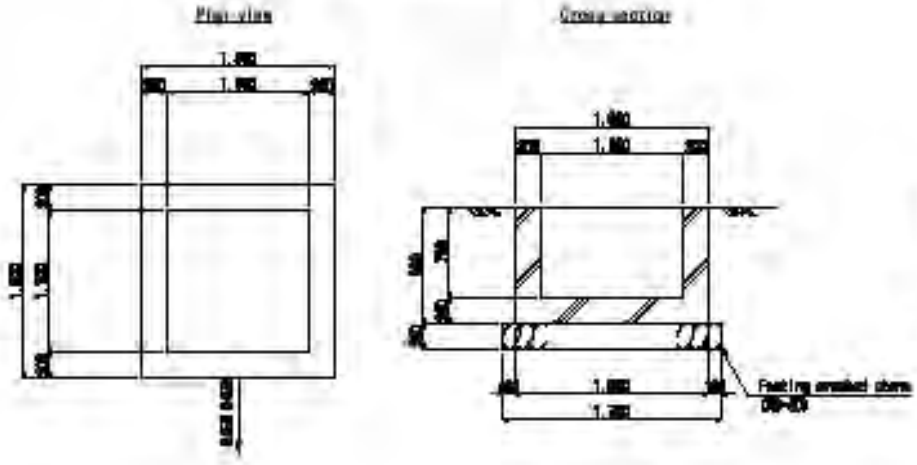
SCALE

DRAWING TITLE : *DETAILS OF PROPOSED TYPE SURFACE DRAINNAGE DITCH*	DRAWING NO: KN/HO/KCD/TY-DRAIN/DR-01A	DESIGNED BY:	RECOMMENDED BY:	*MINISTRY OF DISASTER MANAGEMENT* *LANDSLIDE RESEARCH &* *RISK MANAGEMENT DIVISION* *NATIONAL BUILDING RESEARCH ORGANISATION* *NO : 99/1, JAWATTA ROAD* *COLOMBO -05* *TEL -011-2589946*
	DATE : 20.07.2015	CHECKED BY:	APPROVED BY:	
NUWARA ELIYA	DRAWN BY			

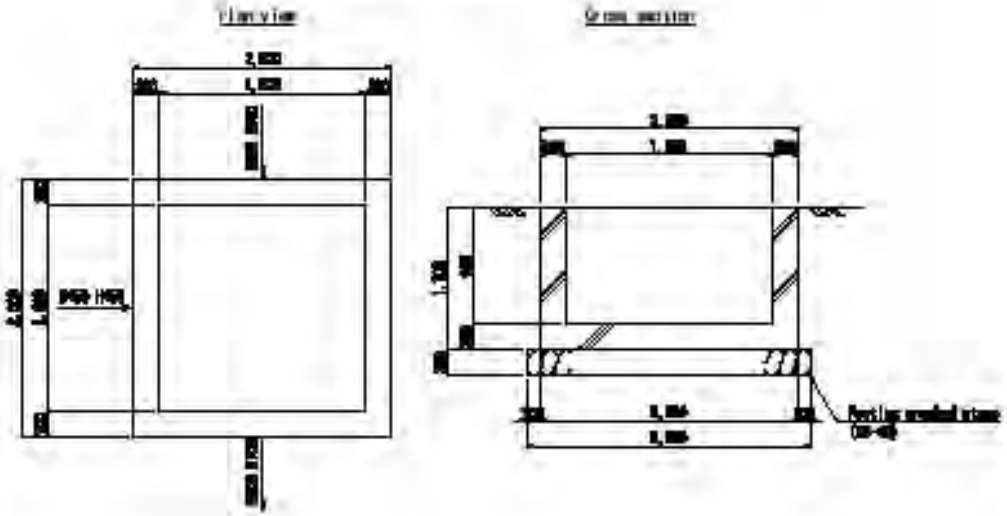
DETAIL FIGURE OF THE WATER COLLECTING PIT

(Nuwara Eliya)

(1,100×1,100×700)

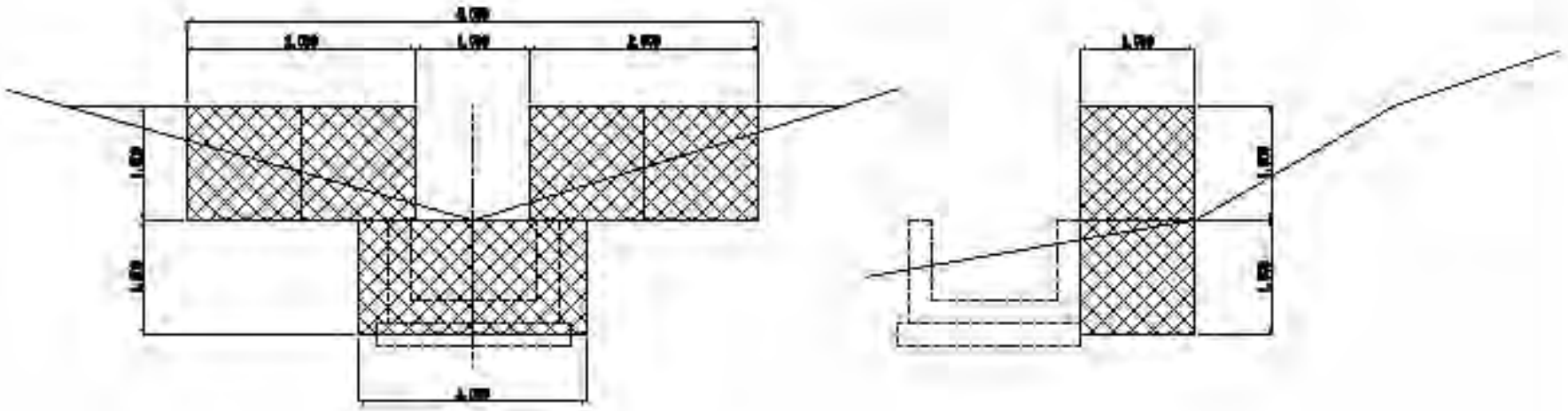


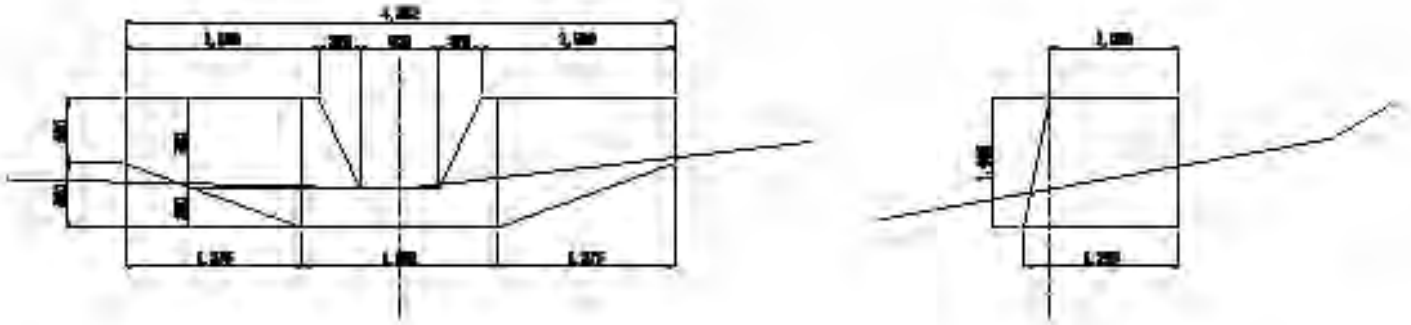
(1,600×1,600×900)

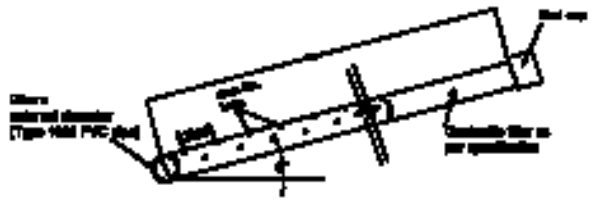


DETAIL FIGURE OF THE SMALL DAM

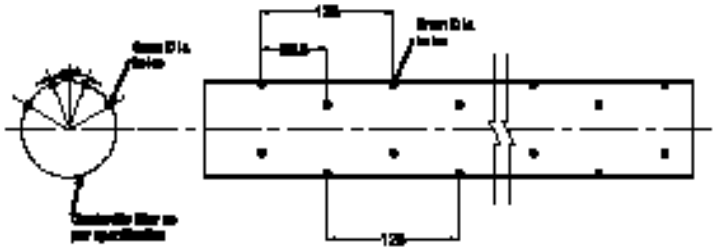
(Nuwara Eliya)

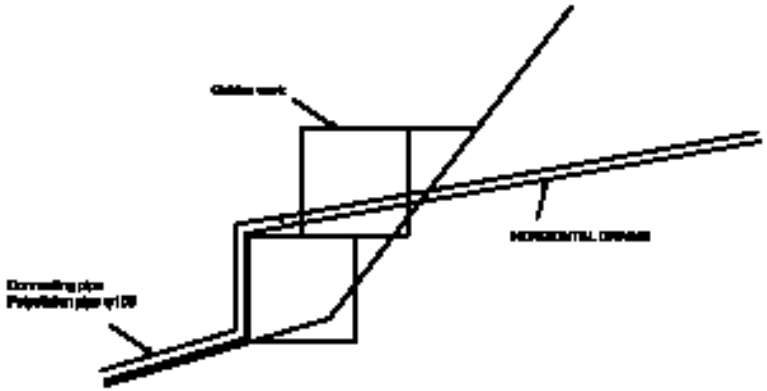






DETAILS OF TYPICAL HORIZONTAL LONG LENGTH DRAINS





SCALE

ALL DIMENSIONS ARE IN MILLIMETERS

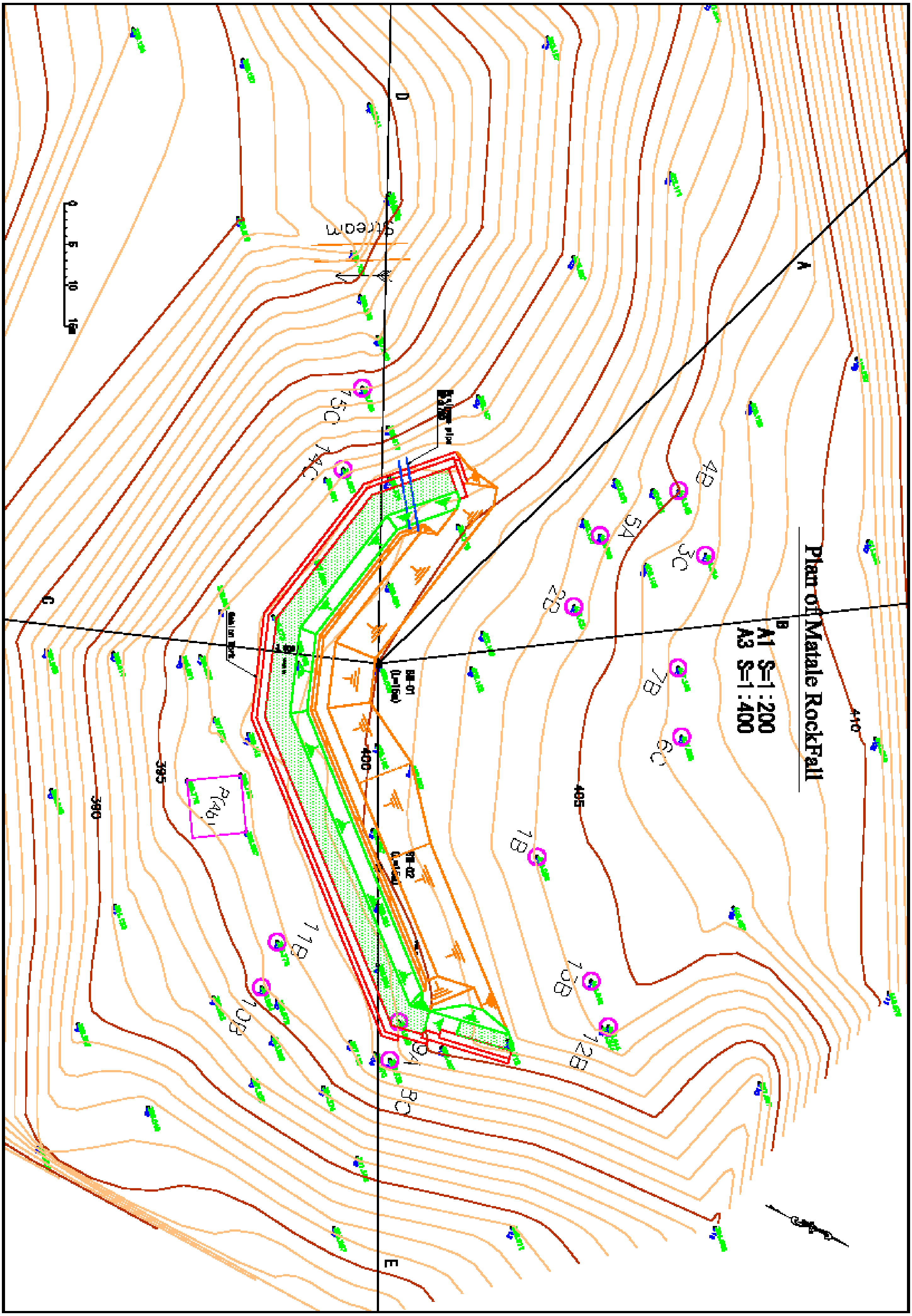
SCALE

ALL DIMENSIONS ARE IN MILLIMETERS

DRAWING TITLE : *DETAILS OF PROPOSED HPRIZONTAL DRAINS*	DRAWING NO: KN/HDK/CDITY-DRAIN/DR-01A	DESIGNED BY:	RECOMMENDED BY:	*MINISTRY OF DISASTER MANAGEMENT* *LANDSLIDE RESEARCH &* *RISK MANAGEMENT DIVISION* *NATIONAL BUILDING RESEARCH ORGANIZATION* *NO : 99/1, JAWATTA ROAD* *COLOMBO -05* *TEL -011-2555945*
	DATE : 06.10.2016	CHECKED BY:	APPROVED BY:	
Nuwara Eliya	DRAWN BY:			

Section 14

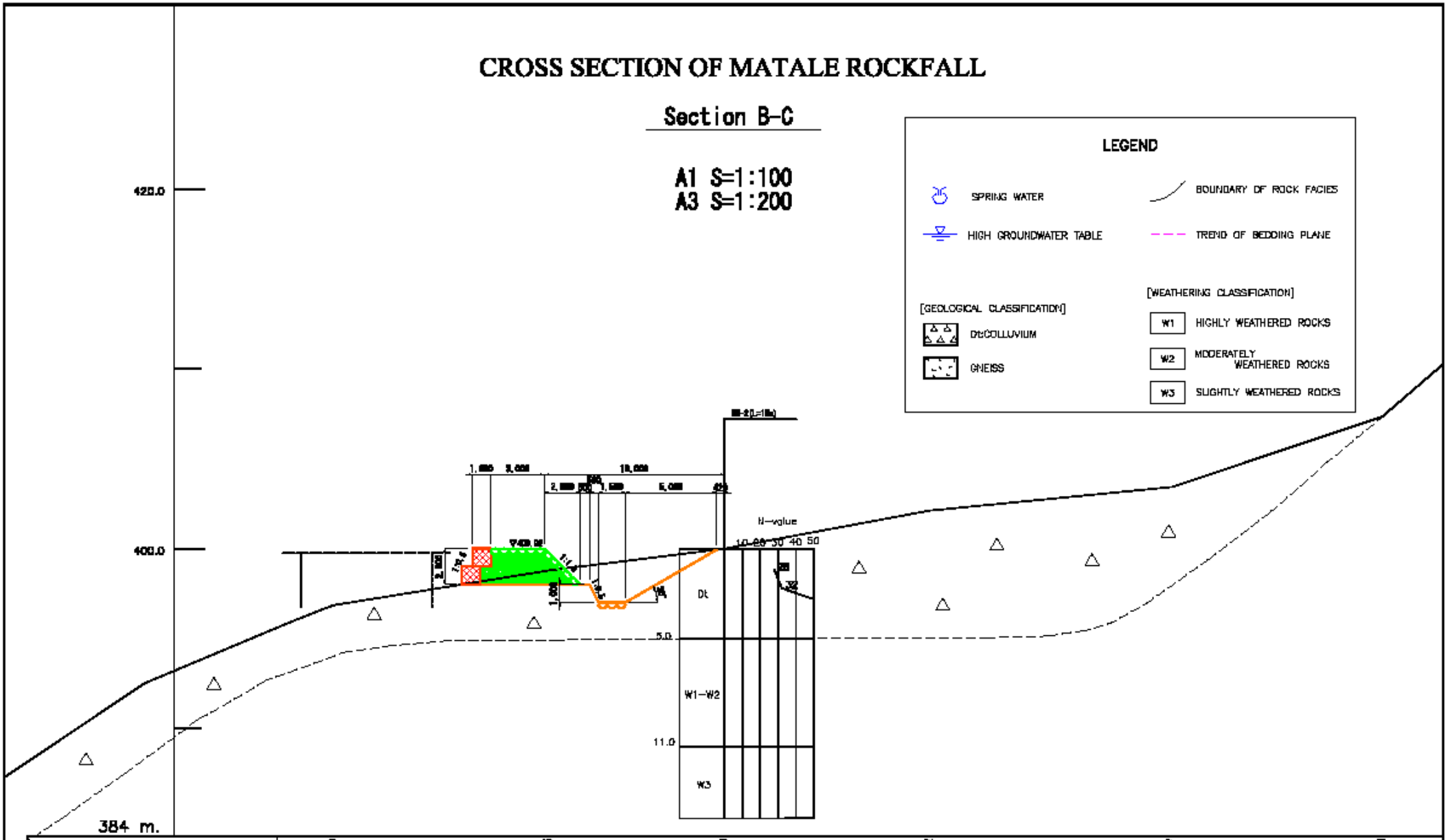
LOT 3. Matale Rock fall mitigation works


Plan of Matale RockFall
A1 S=1:200
A3 S=1:400
410
405
400
395
390
Stream
A
B
C
D
E
4B
3C
5A
2B
7B
6C
1B
13B
12B
11B
10B
9A
8C
15C
14C
0 5 10 15m

CROSS SECTION OF MATALE ROCKFALL

Section B-C

A1 S=1:100
A3 S=1:200

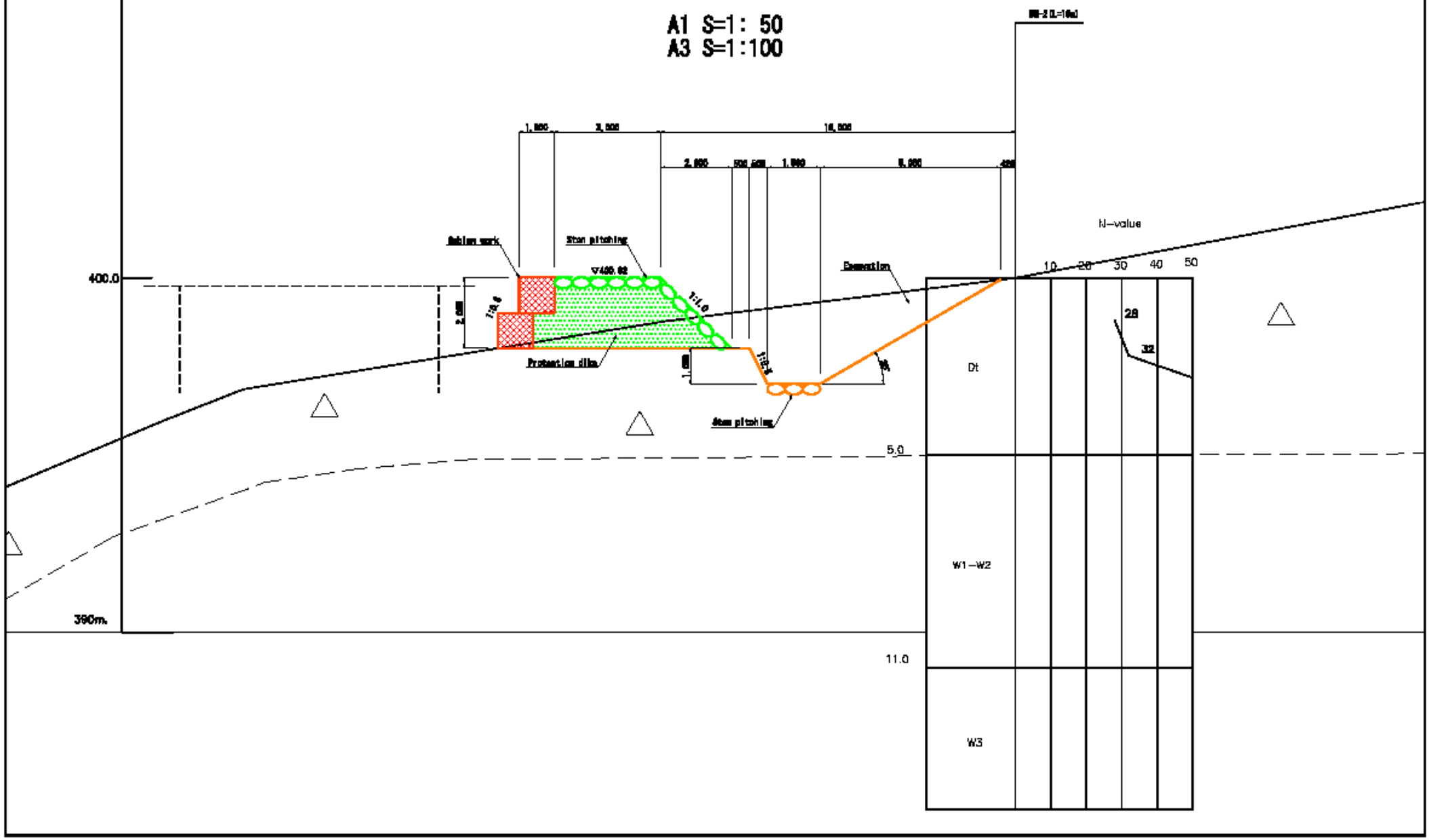


GROUND LEVEL (m)	395.991	396.859	398.793	400.000	402.122	403.437	407.348
HORIZONTAL DISTANCE (m)							

CROSS SECTION OF MATALE ROCKFALL

Section B-C

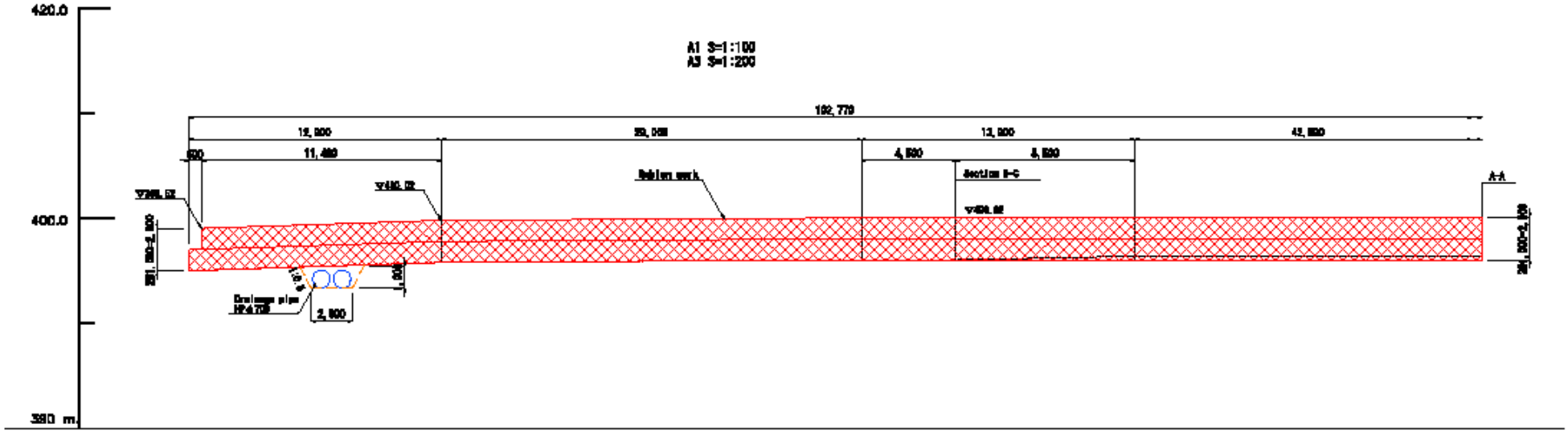
A1 S=1: 50
A3 S=1:100

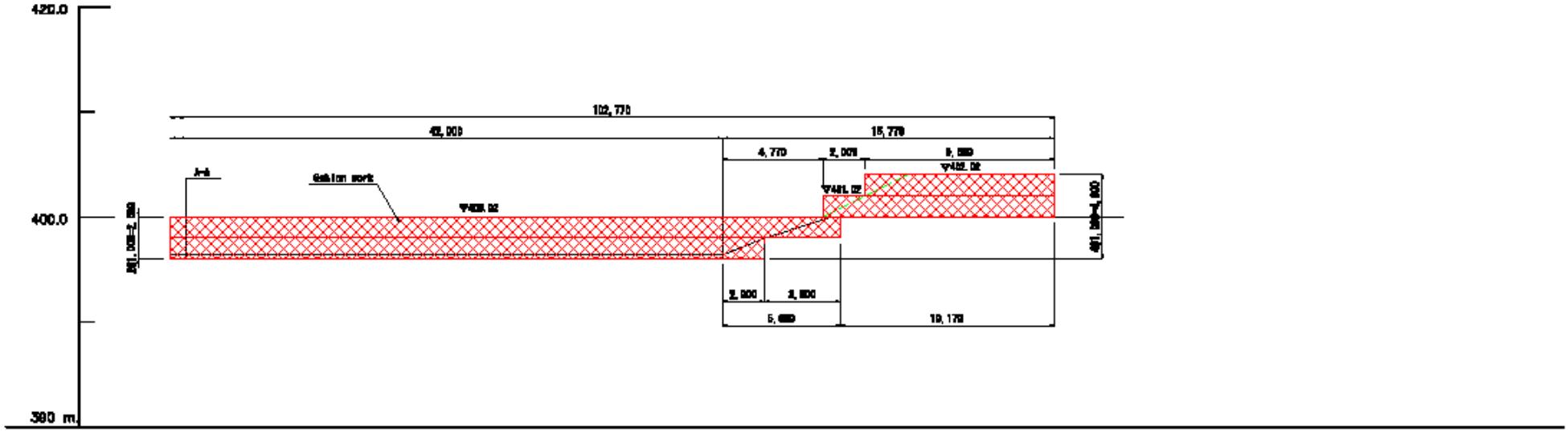


MATALE ROCKFALL

Front elevation of Gabion work

A1 S=1:100
A3 S=1:200





添付資料　9-2

Koslanda 地すべり調査報告

2014.11.5 作成
JICA 土砂災害対策強化プロジェクト作成

Badulla Koslanda 地すべりヘリ調査報告

※今回の調査報告はあくまでヘリ調査のみである。
※今後の調査により記載内容が変更されることがある。

1　調査目的

2014 年 10 月 29 日午前 7：30 頃、Uva 州 Badulla 県 Koslanda で発生した地すべり災害をヘリから調査することにより、その全体概要を把握するとともに、今後の豪雨による影響の概要を把握するために行った。

今回は DMC 及び NBRO 職員も各 1 名同乗し、地すべり災害発生地をヘリにより調査する手法について、OJT により取得することも目的としている。

写真-1　全景

2　調査日

2014 年 11 月 5 日　午前 8:40～9：15
※空軍ヘリをチャーターし実施。

3　調査場所

スリランカ国 Uva 州 Badulla 県 Koslanda Meerivabedda
（首都コロンボから約 100km 東）

4　調査者

JICA スリランカ事務所　島野、Wijeratne Sanath（National staff）
Landslide Mitigation Project 判田（Chief Adviser）、原（Team Leader）
DMC　Srimal Priyantha Samansiri
NBRO　Dayan Sanjeewa Munasinghe

5　調査概要

・ 現時点での被害は以下の通り（DMC situation report 11/05 12:00 時点）
死者　　：12 名
行方不明者　：22 名

・ ヘリからの目測では、地すべり地の傾斜は 30 度未満と推定される。

・ 地すべり地内には現在も水流が確認された。このため、土壌水分が現在でも多いことが推測される。
・ 地すべり頭部は、滑落崖の下方に現在も移動前の状態で残存している部分もあった。また、元の集落のあった場所の少し上部（滑落崖から下流約 250m 付近）に遷急線があり、この部分より斜面上方で地すべりが発生したのではないかと目測から推定された。このため、目測ではあるが、地すべり土塊の４～５割程度が残存していると推定される。

写真-2　地すべり発生箇所の斜面傾斜状況

・ 地すべり下方（渓流から平面図上で約 300m 斜面上部地点）には比較的大きな樹木が３～４本程度残存している。この付近はヘリからの目視でも、地すべり地に向かって左側が深くえぐられたように見えており、地すべり土塊が主に流下したと考えられる。
・ 河川から斜面上部へ約 200～300m 付近に遷緩線あり、その付近から河川まで地すべり土塊が流下した痕跡が見られた。
・ 目視調査では、集落があった場所の下付近で大部分の土塊が堆積しており、斜面の勾配も比較的緩勾配であることから、今後の豪雨により直ちに残存地すべり土塊が流下し、天然ダム化する可能性は低いと考えられる。
・ 地すべり地下部の河川沿いには、目測で 1 km 以上離れたところに集落がまばらに存在している。ほとんどの人家は河川より比較的高いところにあるが、一部河川沿いの低い部分にも人家がいくつか見られた。

写真-3　下流側保全対象

6　今後の対応

・ 斜面の勾配、土塊の堆積状況など、今後現地調査を行わないと不明な部分もあるが、地すべり地内では湧水が現在も続いており、土塊も残っていることから、地すべり地周辺は現在も不安定化している可能性が高いと想定される。特に滑落崖周辺が、今後崩壊が拡大する恐れがあると考えられる。このため周辺住民は引き続き降雨に注意が必要であるとともに、この地すべり地のみならず周辺地域では地すべりを含め土砂災害に注意が必要。
・ また、今回の調査はあくまでヘリからの概要調査であったため、今後現地でのより詳細な調査が必要である。

7　その他

・ 今回の調査は、ヘリのチャーター可能日、天候の関係で、結果的に発災後７日目の実施となった。今後、緊急的に全体概要を把握、周辺住民に避難を呼びかける必要がある災害が発生した場合（例えば、地すべりが河川を閉塞し、その土塊に川の水が溜まって一気に決壊する恐れがある場合や、河川堤防が決壊し大規模な氾濫が発生する恐れがある場合など）には、発災後直ちにヘリ調査が実施可能になるような体制作りが必要と考えられる。今回は DMC・NBRO 職員が同乗したが、今後は、空軍も含めて防災省と防衛・都市計画省間にて災害時の体制構築を推進することを提案する。

以上

写真集

	地すべり頭部の流水状況
	移動土塊の渓流への流入状況
	滑落崖 移動土塊の残存状況
	樹木の残存状況

2014.11.25
JICA 土砂災害対策強化プロジェクト

コスランダ地すべり調査報告(第 2 報)

※今後各種の調査が行われた場合、この記載内容に変更が生じる場合がある。

１．調査目的

11 月 5 日のヘリ調査で、地すべり災害の全体像を把握しているところであるが、より詳細に地すべり現象の確認を行うため、地上での調査を行った。

２．調査日および調査者

2014 年 11 月 19 日　14:10～17:20
　　11 月 20 日　9:30～13:10

JICA Technical Cooperation for Landslide Mitigation Project（土砂災害対策強化プロジェクト）

チーフアドバイザー/土砂災害管理政策	：判田乾一（JICA 長期専門家：地すべり防止工事士）
総括/土砂災害解析	：原　龍一（(株)地球システム科学：地すべり防止工事士）
地すべり対策（設計・施工監理）	：大河原彰（日本工営(株)　　：地すべり防止工事士）

３．　地すべり発生の経緯

地元住民等からの聞き取り結果も踏まえ、被災当日（2014 年 10 月 29 日）の地すべり発生の経緯は、以下の通りと推定される。

① 7 時 15 分ころ、斜面上部(地すべり末端部付近)で、地下水の噴出と斜面崩壊が発生。（You　Tube https://www.youtube.com/watch?v=U1c4sdYopBQ　投稿画像参照）
② 地すべりの土塊全体が、ゆっくりと斜面下方に移動開始。
③ 斜面中央部付近で、豊富な地下水、地表水と相まって一気に土塊が流動化。
④ 流動化した地すべり土塊が土石流となり、斜面下方に向かって移動。(土石流(上部区間))
⑤ 径 5m 以上の巨礫を含む土石流が、斜面中央部付近にあった、寺、職員住宅を破壊し、斜面下部を横断する道路付近に到達
⑥ 道路付近上部の平坦面付近(旧製茶工場およびクリケットグラウンド)に相当量の土砂が堆積したが、さらに土砂の一部は、斜面下部の谷地形に沿って流下し、本川（Eruwendumpola Oya）に到達し、停止した(7 時 30 分ころ)。

４．　地すべり発生の規模

地すべりの発生した斜面は、大きく以下の 3 つに区分される。

① 上部斜面(地すべり):幅約 100m、平均深さ約 15m(頭部滑落崖高さ 20～30m による)、長さ約 260m、地すべり移動土塊量約 26 万 m^3(推定)、地すべり土塊の約半分程度（推定）は、なお上部斜面に残

存している。

② 中部斜面(土石流上部区間)：幅約 150m、最大堆積厚さ約 5m（道路上の平坦面付近の推定)、長さ約 330m、堆積土砂には 5m 程度の巨礫を含む。中部斜面での移動土塊の堆積土量は、約 15 万㎥(推定)。

③ 下部斜面(土石流下部区間)：幅約 30～40m、平均流下厚さ約 3m（渓岸浸食から推定)。移動土塊の先端は、最下部の本川に達しているが、さらに下流部への土砂流下は認められない。

５． 地すべり発生のメカニズム

地すべり発生のメカニズムは、以下の通りと考えられる。

① 平面図に示す通り、今回発生した地すべりは、幅約 280m の旧期の地すべり地形東側側部にあたる。

② 斜面上部の急斜面最上部は黒雲母片麻岩の露出する岩盤急斜面となっており、集水地形となっているため、前日までの豪雨による地表水、地下水が地すべり斜面上部から供給された。

③ 地すべり土塊内部が地下水により飽和状態となり、斜面の不安定化が急速に進み、斜面上部の道路付近での引張亀裂の発生と拡大、地すべり末端部付近での地下水噴出と崩壊発生がほぼ同時(7 時 15 分頃)に起こり、斜面上部全体での地すべりが発生した。

④ 発生した地すべりは、斜面中部に向かって滑動し、豊富な地下水、地表水と相まって土石流化し、斜面下方に存在する、寺、職員住宅、人家等を一気に破壊し、斜面下部の道路付近に到達した。

⑤ 道路上部には、比高差約 10m の地形的高まり(樹木が残存している)と平坦地形(旧クリケットグラウンド)が存在しており、移動速度の低下した土石流土塊（計 5m 程度の巨礫を含む）の大半はほぼ停止したが、それ以下の礫を含む流動性の高い土砂はそのまま沢地形に沿って流下し、斜面最下部の本川に達した。

⑥ 本川に達した土量は極めて少量であり、本川での天然ダムの形成や、さらに下流部への土砂流下は認められない。

⑦ 地すべり発生斜面の上部、および両側部を含む周辺斜面には、旧期の地すべり地形が集中しており、周辺斜面全体が、旧期の地すべり地形で形成されている。今回発生した地すべりの滑落崖近傍には新しい亀裂が残存しており、滑落崖周辺での小規模な崩壊の可能性はあるが、上部斜面を含む周辺の地すべり地形には、周辺踏査、対岸からの観察、地元住民からの聞き取りの範囲内では、顕著な変状は発生していないように見られた。

６． 今後の対応（案）（調査団からの提案）

今回の災害発生を受け、当面、緊急対応として、以下の対応が必要と考えられる。

【ハード対応】

・地すべり範囲内を流下する応急水路および地すべり周囲の迂回水路の設置
・地すべり斜面を横断する道路の仮復旧（電線等のライフライン復旧を含む）
・横断道路山側への、応急土止め構造物（布団籠による）の設置と土砂ポケット確保

【ソフト対応】

・雨量計設置および雨量基準設定による、道路交通の仮復旧
・豪雨時の住民避難計画の策定
・地元住民および製茶工場労働者への防災教育（当面の対応について）

以上

添付資料　9-3

パイロットサイト概況調査

パイロットサイト　概況調書

Site name	Nurse's Training College (Kandy　District)	調査者	Mr.R.Peris (Kandy Office) 判田、原、川上、和田	調査実施日	2014/10/22

災害形態/規模	斜面崩壊	規模	上部斜面　幅100m×長さ20～30m 下部斜面　幅90m×長さ15～20m
地質構造	片麻岩類を基盤とし、地表付近は同岩類の強～完全風化部と崩積土が分布し不安定である。		
植生、土地利用	全面に草本類が繁茂し、潅木も散在している。人工的な改変跡も数箇所認められるが土地利用はされていない。		
現地の概況	対象地区はキャンディ看護学校の背後斜面と前面の斜面であり、いずれも斜面勾配は30～45度、高低差は15～18m程度である。表層部の崩壊を繰り返した経緯があり、2014年10月、12月末の降雨時にも対象地区と周辺斜面で複数個所の崩壊が発生している。		
災害の発生機構	降雨時に大量の雨水が地表面から浸透し、不安定化し崩落する。急斜面であるために崩壊を生じやすい。 深度0.5～1m程度、幅10～20m程度の崩壊が繰り返し発生している。		
被災影響範囲	上部斜面の崩壊により本校舎が土砂の直撃を受け被災する。（斜面末端が1m以内に近接） 下部斜面の崩壊により幹線道路が土砂で埋積し通行不能となる、学校敷地も不安定となり校舎に影響が及ぶ		
調査計画	地形測量：100×150m（1:200）、横断測量L＝50m／本×6箇所 調査ボーリング：15～20m／本×３孔 物理試験：粒度、密度、液性限界		
対策工法および選定理由	地山の安定化のために鉄筋挿入工を施工するとともに、地表面の安定化を考慮し法枠工を併用する。		
施工上の問題点	下部斜面には送電架線と旧崩落時に打設されたスチールプレートがあり、施工時の障害となる。さらに、末端部の道路はバスも通行し交通量が多い。施工範囲の設定に際しては周辺斜面の所有者の確認が必要である。		

状況写真

全景（中央がNursing　school）

下方斜面の末端部の道路

背後斜面と本校舎

学校敷地より下方を見下ろす

パイロットサイト　概況調書

Site name	Alagumale (Matale District)	調査者	Mr.Chaminda Moremada Ms Ayomi Wimalasingha (Matale District Office) 判田、原、川上、和田	調査実施日	2014/10/22

災害形態/規模	落石	規模	最大落差250m、幅150mの斜面区間
地質構造	ざくろ石片麻岩類から構成され、地形の最大傾斜方向に高角度の流れ盤構造を呈する。		
植生、土地利用	上位の急斜面は45度から垂直に近い岩盤が露出し、周辺は潅木や木本類が繁茂している。下位の緩斜面には民家があり、周辺は草本、木本に覆われる。		
現地の概況	対象地区は人家の点在する緩斜面とその背後の急斜面であり、とくに対策工が実施されていないため大きな径の落石が発生した場合、人的被害が生じることが懸念される。		
災害の発生機構	基盤岩に片理や断層を起源とする不連続線が発達し、機械的な風化の進行と降雨や強風を契機として分離し落石が発生していると推察される。大規模な降雨時には土砂と落石が沢地形沿いに集中し、2007年には沢沿いの民家に大きな被害が生じた履歴がある。		
被災影響範囲	緩斜面領域は落石の移動・堆積域にあり、標高320mの街道付近までに被災のリスクがある。		
調査計画	構造物による対策工施工を考慮して緩斜面の上部において調査ボーリング（簡易貫入試験；DCPT）を２－３箇所おこなう。落石経路となりリスクの大きい沢地形付近においても基盤岩の深度を確認する。		
対策工法および選定理由	落石防止工として待ち受け構造の擁壁工（土塁）を下部の緩斜面に設置する。また、落石の集中が懸念される沢部には岩塊、土砂にも対応が可能で水はけのよい堰堤工状の構造物を設置し沢沿いに分布する民家への被害を抑止する。		
施工上の問題点	対策工事を施工すべき緩斜面に至る道路は幅が狭く勾配も急である。また、中途からは人の歩く幅しかない小道となるので新たに工事用道路を設置する必要がある。		

状況写真

民家のある緩斜面から上部の急斜面方向を見る

落石発生源の岩盤斜面

標高410m、遷緩線付近に分布する径5mを超える岩塊

対策工設置を計画する標高400m付近の緩斜面

パイロットサイト　概況調書

Site name	Udamadura (Nuwara Eliya District)	調査者	Ms Chaturi Subasingha (Nuwara Eliya Office) 判田、原、大河原、楊、西川	調査実施日	2014/11/11

災害形態/規模	地すべり	規模	幅400m～500m×長さ900～1000m
地質構造	Highland Complexに位置しており、北西ー南東方向に走る褶曲軸とこれらにほぼ直交した北東ー南西の断層が数多く存在している。 紫蘇輝石片麻岩類を基盤とし、地表付近は同岩類の強破砕～風化部と崩積土が分布しており、不安定な地形を形成する。 縞状構造に起因する破砕帯や亀裂が発達し、潜在的な滑り面が存在していると推定される。		
植生、土地利用	中・上部斜面には草本類・潅木が繁茂し、民家も散在している。下部斜面は主に水田として利用されている。 畑や宅地の造成などの人工的な改変跡が多く見られ、村落内の道路が地すべり地を横断している。		
現地の概況	地形判読により、下部、中部、上部の3つ地すべりブロックに分類されており、中・上部地すべり地は、多丘状凹状台地形を呈しているが、下部地すべりは階段状である。地すべり地は緩斜面で、下部地すべりの斜面勾配は5～１０度で、中・上部地すべりの斜面勾配が20～25度である。 2007年の豪雨時に、下部地すべりを横断している道路に亀裂や段差が発生しており、その付近の民家壁にも亀裂が多く見られた。2012年の降雨により下部地すべりは再活動しており、道路の沈下や家屋の亀裂等の変状が発生した。		
災害の発生機構	降雨時に大量の雨水が地表面から浸透し、地下水位の上昇により地すべりが再活動する。 大規模な中・上部地すべりは、現在、地すべりの活動に伴う地表の新しい変状などは認められていない。		
被災影響範囲	下部地すべりを横断している道路は、地すべりによる段差や亀裂の拡大により、通行不能となることがある。 また、地下水排除工等の地すべり対策が実施されていないため、現在亀裂などの被害を受けている複数の住宅は、地すべりの継続的な活動による変状拡大のリスクがある。		
調査計画	地形測量：200×300m（1:200）、横断測量：600m×2測線＋1200m×1測線 調査ボーリング：20m×1孔+40m×2孔+50m×1孔 弾性波探査：600m×2測線＋1200m×1測線、高密度電気探査：600m×2測線＋1200m×1測線 物理試験：粒度、密度、液性限界など		
対策工法および選定理由	雨期に地すべり活動を繰り返している下部地すべりを対象として、その誘因となる地表面の雨水や浅層地下水を除去するため、横ボーリング工と地表水排除工を計画する。また、地すべり側部に分布している小渓流には小規模な堰堤工を設置し河床および渓岸浸食防止の安定化を図る。		
施工上の問題点	地すべり対策実施のため、場内に工事用道路の設置が必要である。		

状況写真

全景(下部斜面から上部斜面方向を見る)

地すべり活動による道路の段差

下部斜面の状況

地すべり活動により民家壁に発生した亀裂

パイロットサイト　概況調書

Site name	Badulusirigama/Uva Wellasa University (Badulla District)	調査者	Mr.Kalum Senivirathna Ms. Harsahni Perera （Badulla District Office） 羽田、大河原、原、楊、西川	調査実施日	2014/11/13

災害形態/規模	地すべり	規模	幅120m×長さ500～600m
地質構造	沢状の緩斜面に位置し礫混じり土砂によって構成される崩積土地すべりである。		
植生、土地利用	地すべり斜面は１０～15度の緩斜面で、主に草本や木本に覆われている。地すべり末端付近及びその下部斜面には民家が集中している。		
現地の概況	地すべり地全体はいくつかの階段状斜面に分かれており、地表の乱れは著しく、池、渓流、凹地、段差等が各所に見られる。地すべりの末端付近には地すべりの押し出しによる民家などの傾斜や亀裂が認められる。 2007年、2011年及び2012年の雨期には、変位量が小さいが、地すべりは断続的に活動しており、さらに冠頭部斜面や側方斜面は、後退形の小規模地すべりを伴っている。 集中豪雨により地すべり活動が活発化すると、末端部に位置している民家の崩壊と、それに伴う人的被害が生じることが懸念される。		
災害の発生機構	地すべりは繰り返し活動しており、強度の弱いすべり面が形成されている。また、地すべり土塊に多くの亀裂や段差が発生しており、周辺地形と比べて降雨の浸透が著しく、降雨の浸透により亀裂内及びすべり面に間隙水圧が形成され、地すべりは再び活動する。		
被災影響範囲	地すべり斜面及びその末端付近の住宅地にまで、被災のリスクがある。		
調査計画	地形測量：120×580m（1:200）、横断測量：400m×2測線＋800m×1測線 調査ボーリング：20m／本×6孔 弾性波探査：400m×2測線＋800m×1測線、高密度電気探査：400m×2測線＋800m×1測線 物理試験：粒度、密度、液性限界など		
対策工法および選定理由	地すべりの活動は降雨に密接に関連しているため、横ボーリング工(浅層地下水排水工）を中心とし、地表排水工と併用して地すべりの安定を図る。 また、末端付近の村道の変状が著しい場合は、Gabion 擁壁工等を設置し、小規模な変状の抑止も考えられる。		
施工上の問題点	対策工事を施工すべき緩斜面に至る道路は無いため、場内に新たに工事用道路を設置する必要がある。		

状況写真

全景(上部斜面から下部斜面方向を見る)

地すべり斜面に見られる池

地すべり活動による地表の変状

地すべり崩積土(礫まじり土砂)