

資料5 ソフトコンポーネント計画書

東ティモール国ブルト地区灌漑施設改修計画準備調査

ソフトコンポーネント計画書

目次

| | | |
|------|----------------------------|---|
| (1) | ソフトコンポーネント計画の背景..... | 1 |
| (2) | ソフトコンポーネントの目標..... | 1 |
| (3) | ソフトコンポーネントの成果..... | 1 |
| (4) | 成果達成度の確認方法..... | 1 |
| (5) | ソフトコンポーネントの活動..... | 1 |
| (6) | ソフトコンポーネント実施リソースの調達方法..... | 2 |
| (7) | ソフトコンポーネントの実施工程..... | 3 |
| (8) | ソフトコンポーネントの成果品..... | 3 |
| (9) | ソフトコンポーネントの概略事業費..... | 3 |
| (10) | 東ティモール側の責務..... | 3 |

(1) ソフトコンポーネント計画の背景

「東ティモール国ブルト灌漑施設改修計画」は、既存の小規模の伝統的灌漑システムを、頭首工を備えた近代的灌漑システムに改修し、対象地域の農業生産の向上を目指すものである。その目的の持続的な発現のためには、適切な灌漑施設の維持管理と、公平で適正な水配分が非常に重要となる。基幹施設は農業水産省灌漑水管理局が管理する方針とするが、末端施設は水利組合（WUA）が運営維持管理を行う方針である。本事業の実施により従来の小規模な灌漑スキームがひとつに統合されることになり、既存の小規模な水利組合を統合し、より組織的な運営管理が求められる。また、灌漑スキームの規模が拡大されることにより、灌漑水を地区全体に適切に配分するためには、従前よりもさらに組織的な公平な水管理が必要となる。

そのため、まず灌漑水管理局の維持管理所管部署である水管理課（Department of Water Management）とともに水利組合の設立支援を行い、その組織運営能力強化を計ることが必要である。また、新規灌漑施設の運営に関して技術的指導を行い、水管理要領を作成し、適切な運営維持管理ができるように支援を行う。このような技術支援をソフトコンポーネントにより実施するものである。

(2) ソフトコンポーネントの目標

現状の施設維持管理活動と水管理状況に鑑み、東ティモール国側が協力事業完了後も継続的な活動を実施することを前提に、「関係者が改修された灌漑施設の維持管理と水管理のために必要な知識を習得する」ことを目標としてソフトコンポーネントを計画する。

(3) ソフトコンポーネントの成果

上記の目標を達成するための成果は、維持管理・水管理の責務を負っている農業水産省灌漑水管理局水管理課や県農業事務所および水利組合（WUA）の関係者を対象として「施設維持管理能力の向上」を図ることである。

(4) 成果達成度の確認方法

ソフトコンポーネントの成果達成度の判定は、①当該地域における水利組合の登録と組織規程を確認、②水管理要領の作成を確認、③研修・指導の実施状況や研修後のアンケート調査等を含む研修記録による灌漑施設の操作と維持管理技術の習得を確認することなどにより行う。

(5) ソフトコンポーネントの活動

具体的な活動内容については下表に示すとおりであり、水利組合の設立支援と能力強化、および水管理技術の指導などからなるものとする。なお、活動項目(7)については、納入業者によるゲート等の施設・機材の操作方法の指導が終わった後、水管理要領とその灌漑計画に沿った施設の適切な運用と維持管理に関する指導をソフトコンポーネントで行う計画である。

資料 5.1 ソフトコンポーネントの活動内容

| 支援プログラム名 | 対象者 | 活動 |
|-----------|-----------|--|
| 水利組合の設立支援 | 受益農民 | (1) 水利組合 (WUA) の設立： <ul style="list-style-type: none"> ・WUA 設立に向けた説明会の開催 ・灌漑受益者リストの作成 ・組合幹部の責務説明 ・メンバーシップの検討 ・組織幹部の選定 (2) 組織規程の策定： <ul style="list-style-type: none"> ・ラクロ灌漑地区へのスタディーツアーを実施 (組織運営中心、WUA 幹部等を対象) ・WUA 組織規程 (案) の策定・協議 ・WUA 集会所の運用・管理方法にかかる協議 ・WUA 組織規程の策定 (3) 政府登録の支援： <ul style="list-style-type: none"> ・政府登録の手続きに関する説明 ・政府登録の手続き支援 ・政府登録 (WUA 証明書) の受領 |
| 施設運営・維持管理 | 政府職員、受益農民 | (4) 水管理要領の策定： <ul style="list-style-type: none"> ・灌漑用水量と水利費にかかる協議 ・水管理要領 (案) の作成 (灌漑水供給、施設維持管理、水利費徴収などを含む) (5) 水管理要領の見直し・改善： <ul style="list-style-type: none"> ・水管理技術指導 (下記) の結果を受けて水管理要領の見直し・改善 ・水管理要領の策定 |
| 水管理指導 | 政府職員、受益農民 | (6) 水管理技術指導： <ul style="list-style-type: none"> ・ラクロ灌漑地区へのスタディーツアーを実施 (水管理技術中心、WUA 幹部とゲート操作人等を対象) ・灌漑ブロックに関する技術的説明 ・水管理に関わる実地訓練 (7) 施設操作・維持管理技術移転： <ul style="list-style-type: none"> ・灌漑計画に沿った施設操作に関わる実地訓練 ・施設の維持管理に関わる技術指導 |

(6) ソフトコンポーネント実施リソースの調達方法

事業完了後の継続的な活動を見据え、東ティモール国政府技術職員 (C/P) が活動に主体的に取り組むことができるよう、ソフトコンポーネント開始当初から、彼らを活動に巻き込み共同で実施することが重要である。そのため、ソフトコンポーネントの実施体制は、農業水産省灌漑水管理局水管理課の技術職員 (C/P) を主体とし、邦人コンサルタント技術者がこれを支援することとする。

a) 邦人専門家：1名

邦人専門家は、水利組合 (WUA) の組織運営と水管理技術を含む灌漑施設の運営維持管理指導の経験をもち、ソフトコンポーネント業務全体の管理とカウンターパートの指導ができる人物を想定する。現地業務は、1.0 カ月と 0.7 カ月の 2 回の渡航とし、合計 1.7 人月と計画する。1 回日の渡航では上記活動内容のうち(1)～(4)を、2 回日の渡航では(5)～(7)を実施する。

b) 実施機関カウンターパート (C/P)：3名

灌漑水管理局水管理課の灌漑技術者 (1名) とマナツト県及びパウカウ県農業事務所の灌漑技術者 (各1名) を想定する。この C/P は、ソフトコンポーネント実施後には、水利組合活動のモニタリングと適宜、追加指導・研修を行うものとする。

(7) ソフトコンポーネントの実施工程

工事がある程度進んだ時点で水利組合の設立支援を開始し、主要灌漑施設が整備される時点において水管理技術の指導等を実施する。その間カウンターパートが組織育成の支援を継続することとし、全期間は約12ヶ月間と計画する。

資料 5.2 ソフトコンポーネント実施工程および要員配置

| 月順 | 1 | 2 | ... | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
|------------------|------|---|-----|---|----|----|----|----|----|----|----|----|----|----|----|-------|----|
| 支援項目 | 工事期間 | | | | | | | | | | | | | | | 稲作1作目 | |
| (1)水利組合の設立支援 | | | | | ■ | ■ | | | | | | | | | | | |
| (2)組織規定の策定 | | | | | ■ | ■ | | | | | | | | | | | |
| (3)政府登録の支援 | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | |
| (4)水管理要領の策定 | | | | | ■ | ■ | | | | | | | | | | | |
| (5)水管理技術指導 | | | | | | | | | | | | | | ■ | ■ | ■ | ■ |
| (6)水管理要領の見直し・改善 | | | | | | | | | | | | | | | ■ | ■ | ■ |
| (7)施設操作・維持管理技術移転 | | | | | | | | | | | | | | | ■ | ■ | ■ |
| アサイメント計画 | | | | | | | | | | | | | | | | | |
| 邦人専門家 (1名) | | | | | ■ | ■ | | | | | | | | | ■ | ■ | |
| カウンターパート (3名) | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

(8) ソフトコンポーネントの成果品

ソフトコンポーネントの成果品として、①ソフトコンポーネント完了報告書、②水管理要領を取りとりまとめ、対象となる水利組合、東ティモール国政府および JICA に提出する。

(9) ソフトコンポーネントの概略事業費

ソフトコンポーネントにかかる費用（邦人コンサルタント分）は、下表に示すとおり、合計約450万円と見積もられる。

資料 5.3 ソフトコンポーネントの概算事業費

| 項目 | 事業費 (千円) | | |
|---------------------|----------|------|-------|
| | 円貨分 | 現地貨分 | 合計 |
| A 直接人件費 (邦人コンサルタント) | 1,064 | 0 | 1,064 |
| B 直接経費 (邦人コンサルタント) | 1,475 | 604 | 2,079 |
| C 間接費 (邦人コンサルタント) | 1,362 | 0 | 1,362 |
| 合計 | 3,901 | 604 | 4,505 |

(*:四捨五入により一部合計の不一致がある)

(10) 東ティモール側の責務

本事業で改修される灌漑施設は、東ティモール国側で運営維持管理を行うことで合意されている。ソフトコンポーネントの目標達成にあたり、この前提条件に基づいて、東ティモール国側が責任を持って実施すべき活動内容は、以下の通りである。

- a) カウンターパート職員3名の提供（活動費を含む）
- b) 活動のための事務所スペースの提供
- c) 水利組合（WUA）の組織運営状況に関する継続的なモニタリングとモニタリング結果に従った適切な助言と追加研修



REPÚBLICA DEMOCRÁTICA DE TIMOR LESTE
MINISTÉRIO DE AGRICULTURA E PESCAS
GABINETE DO DIRETOR GERAL



No. 625/GDG/VII/2013

Dili, 24th July 2013

No.26, Farol Area, Dili, Timor-Leste

JICA Timor - Leste Office

Attention: Mr. Hirohiko TAKATA, the Chief Representative of JICA Timor - Leste Office

Subject: Submission of the report of land acquisition on the Project for Rehabilitation of Buluto Irrigation Scheme

Dear Sir,

We are honorable to inform you that we would submit you the report of land acquisition on the Project for Rehabilitation of Buluto Irrigation Scheme with signature of all land users' concerned. The land listed in the attached papers is provided voluntarily from all of land user's.

The agreement from land users' concerned which provided was implemented as the following process:

1. The lists of users' on the land for constructing and improving the facilities concerned were made by the JICA Study Team.
2. The public consultation meetings were held to explain beneficiaries the outline of the Project. All participants show their strong incentive to the Project.
3. Both of Manatuto and Baucau District Agriculture Office explain land users' concerned the outline of the Project and get their agreement to provide their land voluntary for the proposed space of weir, expansion of canals, and other facilities concerned.

It is appreciated if you would progress the Japanese Grant Aid Process on the Project for Rehabilitation of Buluto Irrigation Scheme.

With best regards,

Lourenço Borges Fontes

Director General

- CC:
1. Minister for Ministry of Agriculture and Fisheries,
 2. Vice Minister for Ministry of Agriculture and Fisheries
 3. National Director for Irrigation and Water Management

**The Preparatory Survey for the Project for Rehabilitation of Buluto Irrigation Scheme
in the Democratic Republic of Timor-Leste (JICA)**

**List of Land Users for Land Acquisition
on Construction of Irrigation and related Facilities**

June 2013

**National Directorate for Irrigation and Water Management
Ministry of Agriculture and Fisheries**

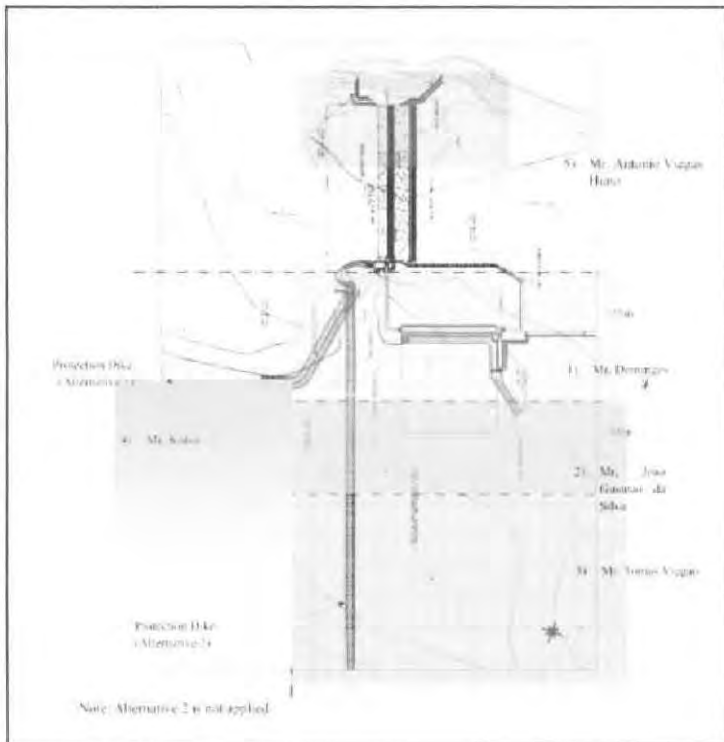
Contents

| | | |
|----|---|----|
| 1. | Left Bank and Right Bank of the Intake Facilities | 1 |
| 2. | A. Main Irrigation Canal | 2 |
| | B. Secondary Irrigation Canal (No.1 – No. 16) | 7 |
| 3. | Drainage Canals | 25 |
| 4. | WUA Meeting Facilities | 27 |
| 5. | Felling Trees | 28 |

1. Left Bank and Right Bank of the Intake Facilities

Result of Survey for Land Acquisition

A. LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO INTAKE FACILITIES CONSTRUCTION



| No | Date | Name | Land use | Signature |
|-----------------|------|----------------------|----------------------|------------|
| Left Bank Side | | | | |
| 1 | | Antonio Viegas Huno | Farm Land (0.5ha) | <i>AVH</i> |
| Right Bank Side | | | | |
| 1 | | Domingos | Forest Area | <i>D</i> |
| 2 | | Joao Gusmão Da Silva | Forest Area | <i>JGS</i> |
| 3 | | Tomas Viegas | Forest Area | <i>T</i> |
| 4 | | Daughter of Kaisi | Forest Area | <i>SK</i> |

A6 - 4

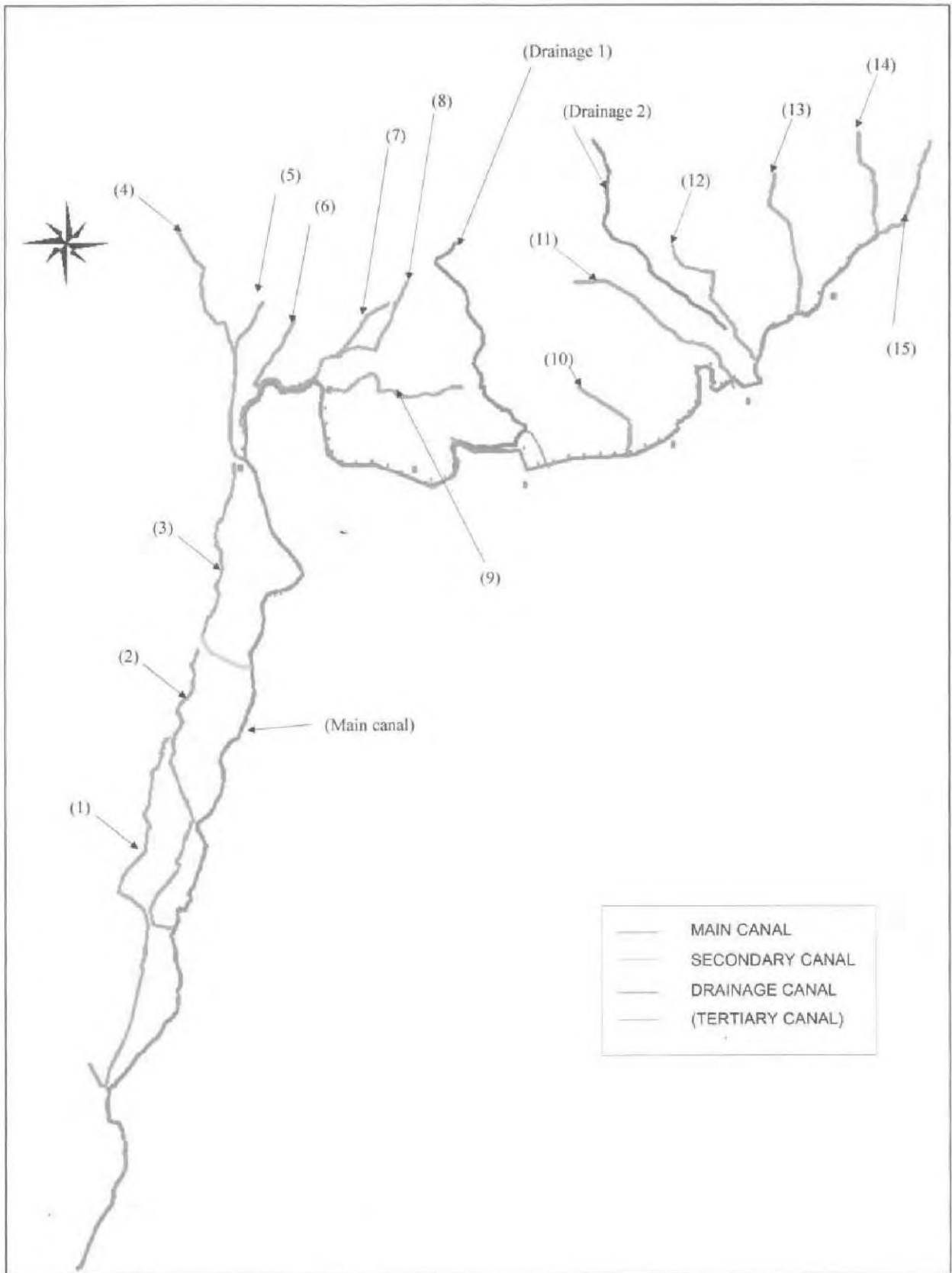


Fig. - 1 Canal Network

2. Main Irrigation Canal

Result of Survey for Land Acquisition

A. LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE MAIN CANALCONSTRUCTION

| No | Date | Name | Left side Distance(m) | Right side Distance (m) | Left side survey point | | Right side survey point | | Land use | Signature |
|----|------|------------------------------------|---------------------------|----------------------------|---------------------------|-------|----------------------------|-------|-----------------------------------|-----------|
| 1 | | (Government) | 1390 | 5985 | | | | | Potential land for Agriculture | |
| 2 | | Domingos de Araujo | 228 | 228 | 0+000 | 0+228 | 0+000 | 0+228 | Potential land for Agriculture | |
| 3 | | Joao Gusumao | 300 | 300 | 0+228 | 0+528 | 0+228 | 0+528 | Potential land for Agriculture | |
| 4 | | Tomas Amaral Ximenes | 150 | 150 | 0+528 | 0+678 | 0+528 | 0+678 | Potential land for Agriculture | |
| 5 | | Agustinho Gusumao | 220 | 220 | 0+678 | 0+898 | 0+678 | 0+898 | Potential land for Agriculture | |
| 6 | | Sebastiao Guran de Sousa | 210 | 210 | 0+898 | 1+098 | 0+898 | 1+098 | Potential land for Agriculture | |
| 7 | | Tome Domingos de Sousa | 132 | 252 | 1+098 | 1+230 | 1+098 | 1+350 | Farm Land | |
| 8 | | Domingos Sera Gusmao | 20 | 0 | 1+230 | 1+250 | Government L=550m | | Farm Land | |
| 9 | | Miguel de Sousa Naek | 50 | 0 | 1+250 | 1+300 | | | Farm Land | |
| 10 | | Joao Alfredo | 50 | 0 | 1+300 | 1+350 | | | Farm Land | |
| 11 | | Simao Gusmao | 100 | 0 | 1+350 | 1+450 | | | Farm Land | |
| 12 | | Sebastiao Gura Sousa | 50 | 0 | 1+450 | 1+500 | | | Farm Land | |
| 13 | | Domingos de Sousa | 250 | 0 | 1+500 | 1+750 | | | Farm Land | |
| 14 | | Marcelo Caitano de Sousa | 100 | 0 | 1+750 | 1+850 | | | Farm Land | |
| 15 | | Zito Clementino de Sousa | 150 | 10 | 1+850 | 2+000 | | | 1+990 | 2+000 |
| 16 | | Luis Alexandre de Sousa | 125 | 0 | 2+000 | 2+125 | Government L=1,050m | | Farm Land | |
| 17 | | Ursula de Sousa | 250 | 0 | 2+125 | 2+375 | | | Farm Land | |
| 18 | | Luis Soares | 25 | 0 | 2+375 | 2+400 | | | Farm Land | |
| 19 | | Julio Kere Gusmao | 175 | 0 | 2+400 | 2+575 | | | Farm Land | |
| 20 | | Unknown <i>João Alfredo Soares</i> | 145 | 0 | 2+575 | 2+720 | | | Farm Land | |

| No | Date | Name | Left side Distance(m) | Right side Distance (m) | Left side survey point | | Right side survey point | | Land use | Signature |
|----|------|-------------------------------------|---------------------------|----------------------------|---------------------------|-------|----------------------------|-------|-----------|-----------|
| 21 | | Carlito da Costa | 230 | 0 | 2+720 | 2+950 | | | Farm Land | |
| 22 | | Antonio Buik Gusmao | 50 | 0 | 2+950 | 3+000 | | | Farm Land | |
| 23 | | Sebastião Boru de Sousa | 100 | 0 | 3+000 | 3+100 | | | Farm Land | |
| 24 | | Vicente Gusmao | 50 | 0 | 3+100 | 3+150 | | | Farm Land | |
| 25 | | Vicente Bohak | 0 | 100 | | | 3+050 | 3+150 | Farm Land | |
| 26 | | Jacinto Sekar Gusmao | 110 | 0 | 3+150 | 3+260 | Government L=700m | | Farm Land | |
| 27 | | Estefania de Sousa | 240 | 0 | 3+260 | 3+500 | | | Farm Land | |
| 28 | | Joao Kai | 12 | 0 | 3+500 | 3+512 | | | Farm Land | |
| 29 | | Simao Hunu Viegas | 38 | 0 | 3+512 | 3+550 | | | Farm Land | |
| 30 | | Teozoro da Silva | 50 | 0 | 3+550 | 3+600 | | | Farm Land | |
| 31 | | Agapito Viegas | 100 | 0 | 3+600 | 3+800 | | | Farm Land | |
| 32 | | Miguel Viegas | 150 | 0 | 3+800 | 3+850 | | | Farm Land | |
| 33 | | Joao Gusmao Luan | 175 | 50 | 3+850 | 4+025 | 3+850 | 3+900 | Farm Land | |
| 34 | | Antonio Viegas l'ak | 75 | 0 | 4+025 | 4+100 | | | Farm Land | |
| 35 | | Jose Gusmao To | 125 | 0 | 4+100 | 4+225 | | | Farm Land | |
| 36 | | Julio Gusmao Meta | 275 | 0 | 4+225 | 4+500 | | | Farm Land | |
| 37 | | Vicente dos Remedés de Sousa | 70 | 0 | 4+500 | 4+570 | | | Farm Land | |
| 38 | | Domingos Gusmao | 80 | 0 | 4+570 | 4+650 | | | Farm Land | |
| 39 | | Jose Horacio | 50 | 0 | 4+650 | 4+700 | | | Farm Land | |
| 40 | | Antonio Bai | 110 | 0 | 4+700 | 4+810 | | | Farm Land | |
| 41 | | Lucas Salvador Lindolfo de Sousa | 125 | 0 | 4+810 | 4+900 | | | Farm Land | |
| 42 | | Jose Nero Gusmao | 50 | 0 | 4+900 | 4+950 | | | Farm Land | |
| 43 | | Costorio de Sousa | 100 | 0 | 4+950 | 5+050 | | | Farm Land | |
| 44 | | Casa Badak Viegas | 125 | 0 | 5+050 | 5+175 | | | Farm Land | |
| 45 | | Tomas Marques Viegas | 75 | 0 | 5+175 | 5+250 | | | Farm Land | |
| 46 | | Julio Mendes | 75 | 0 | 5+250 | 5+325 | | | Farm Land | |

| No | Date | Name | Left side Distance(m) | Right side Distance (m) | Left side survey point | | Right side survey point | | Land use | Signature |
|----|------|-------------------------|---------------------------|----------------------------|---------------------------|--------|----------------------------|--------|------------------------|--------------------|
| 47 | | Duarte Gusmao | 295 | 0 | 5+325 | 5+620 | Government L=3,260m | | Farm Land | <i>[Signature]</i> |
| 48 | | Mario Assuncao Gusmao | 150 | 0 | 5+620 | 5+770 | | | Farm Land | <i>[Signature]</i> |
| | | | | | | | | | Government L=1,390m | |
| 49 | | Jose Hendrique de Sousa | 250 | 250 | 7+160 | 7+410 | 7+160 | 7+410 | Farm Land | <i>[Signature]</i> |
| 50 | | Maskai da Silva | 150 | 150 | 7+410 | 7+560 | 7+410 | 7+560 | Farm Land | <i>[Signature]</i> |
| 51 | | Hermegildo Maskai | 160 | 160 | 7+560 | 7+720 | 7+560 | 7+720 | Farm Land | <i>[Signature]</i> |
| 52 | | Marcelino Soares | 30 | 30 | 7+720 | 7+750 | 7+720 | 7+750 | Farm Land | <i>[Signature]</i> |
| 53 | | Felizarda Soares | 60 | 60 | 7+750 | 7+810 | 7+750 | 7+810 | Farm Land | <i>[Signature]</i> |
| 54 | | Luis Laleia | 330 | 330 | 7+810 | 8+140 | 7+810 | 8+140 | Farm Land | <i>[Signature]</i> |
| 55 | | Nico Loi Paicheco | 40 | 40 | 8+140 | 8+180 | 8+140 | 8+180 | Farm Land | <i>[Signature]</i> |
| 56 | | Evaristo Freitas | 630 | 630 | 8+180 | 8+810 | 8+180 | 8+810 | Farm Land | <i>[Signature]</i> |
| 57 | | Nico Loi Paicheco | 250 | 250 | 8+810 | 9+060 | 8+810 | 9+060 | Farm Land | <i>[Signature]</i> |
| 58 | | Lamberto Freitas | 250 | 0 | 9+060 | 9+310 | Government L=250m | | Farm Land | <i>[Signature]</i> |
| 59 | | Domingos Soares | 20 | 20 | 9+310 | 9+330 | 9+310 | 9+330 | Road | <i>[Signature]</i> |
| 60 | | Paulino Domingos Faria | 80 | 0 | 9+330 | 9+410 | Government L=80m | | Road | <i>[Signature]</i> |
| 61 | | Aleixo Faria | 505 | 505 | 9+410 | 9+915 | 9+410 | 9+915 | Road | <i>[Signature]</i> |
| 62 | | Cosme da Silva | 20 | 0 | 9+915 | 9+935 | Government L=95m | | Road | <i>[Signature]</i> |
| 63 | | Guilherme Soares | 75 | 0 | 9+935 | 10+010 | | | Road | <i>[Signature]</i> |
| 64 | | Joanico Soares | 170 | 170 | 10+010 | 10+180 | 10+010 | 10+180 | Road | <i>[Signature]</i> |
| 65 | | Joao da Costa Freitas | 35 | 0 | 10+180 | 10+215 | | | Road | <i>[Signature]</i> |
| 66 | | Joanico Freitas | 0 | 5 | | | 10+180 | 10+185 | House | <i>[Signature]</i> |
| 67 | | Eduarda da Silva | 0 | 50 | | | 10+185 | 10+235 | House | <i>[Signature]</i> |
| 68 | | Luis da Silva | 45 | 0 | 10+215 | 10+260 | | | House | <i>[Signature]</i> |
| 69 | | Mafalda | 50 | 75 | 10+260 | 10+310 | 10+235 | 10+310 | House | <i>[Signature]</i> |
| 70 | | Duarte Freitas | 110 | 110 | 10+310 | 10+420 | 10+310 | 10+420 | House | <i>[Signature]</i> |


| No | Date | Name | Left side Distance(m) | Right side Distance (m) | Left side survey point | | Right side survey point | | Land use | Signature |
|----|------|---------------------------------------|---------------------------|----------------------------|---------------------------|--------|----------------------------|--------|-----------|-----------|
| 71 | | Joao Lela da Silva | 310 | 410 | 10+420 | 10+730 | 10+420 | 10+830 | House | |
| 72 | | Domingos Ramos Correia | 20 | 0 | 10+730 | 10+750 | | | House | |
| 73 | | Joao da Costa Freitas | 320 | 180 | 10+750 | 11+060 | 10+830 | 11+010 | House | |
| 74 | | Rui Manuel | 2 | 0 | 11+060 | 11+062 | | | House | |
| 75 | | Felizarda Viegas | 0 | 90 | | | 11+010 | 11+100 | House | |
| 76 | | Carlos Freitas | 0 | 150 | | | 11+100 | 11+250 | House | |
| 77 | | Antonio Luis da Silva | 48 | 160 | 11+062 | 11+110 | 11+640 | 11+680 | House | |
| 78 | | Leopoldo Freitas | 150 | 0 | 11+110 | 11+260 | | | House | |
| 79 | | Mateus da Silva | 0 | 210 | | | 11+250 | 11+460 | Farm Land | |
| 80 | | Vitor Correia | 125 | 0 | 11+260 | 11+385 | | | Farm Land | |
| 81 | | Sebastiao Correia | 215 | 140 | 11+385 | 11+600 | 11+460 | 11+600 | Farm Land | |
| 82 | | Beto Kai Correia | 80 | 40 | 11+600 | 11+680 | 11+600 | 11+640 | Farm Land | |
| 83 | | Marcelino Bosi Oro Soares (Waigia) | 654 | 654 | 11+680 | 12+334 | 11+680 | 12+334 | Farm Land | |
| | | Total Distance | 12334 | 12334 | | | | | | |

B. Secondary Canals

LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE SECONDARY CANAL NO.1 CONSTRUCTION

| No | Date | Name | Left side Distance (m) | Right side Distance (m) | Left side survey point | | Left side survey point | | Signature |
|----|------|-----------------------------|------------------------|-------------------------|------------------------|----------|------------------------|----------|-----------|
| | | | | | HM 1+00 | HM 3+00 | HM 1+00 | HM 3+00 | |
| 1 | | Miguel Sousa Naek | 200 | 200 | HM 1+00 | HM 3+00 | HM 1+00 | HM 3+00 | MS MS |
| | | | 0 | 100 | | | HM 4+50 | HM 5+50 | |
| 2 | | Domingos Hera | 100 | 0 | HM 3+00 | HM 4+00 | | | DHR |
| 3 | | Joao Alfredo de Sousa | 50 | 100 | HM 4+00 | HM 4+50 | HM 3+00 | HM 4+00 | Joas |
| 4 | | Simao Ximenes | 0 | 50 | | | HM 4+00 | HM 4+50 | |
| 5 | | Rosa Lau de Sousa | 100 | 0 | HM 4+50 | HM 5+50 | | | |
| 6 | | Tome Domingos de Sousa | 0 | 200 | | | HM 5+50 | HM 7+50 | |
| 7 | | Gregorio Hendrique de Sousa | 200 | 0 | HM 5+50 | HM 7+50 | HM | HM | |
| 8 | | Zito Clementino de Sousa | 0 | 50 | | | HM 7+50 | HM 8+00 | |
| 9 | | Joao Viegas Malela | 50 | 0 | HM 7+50 | HM 8+00 | | | |
| 10 | | Antonio de Sousa Correia | 100 | 100 | HM 8+00 | HM 9+00 | HM 8+00 | HM 9+00 | |
| 11 | | Raul Ximenes | 150 | 0 | HM 9+00 | HM 10+50 | | | |
| 12 | | Antonio Dara de Sousa | 0 | 125 | | | HM 9+00 | HM 10+25 | |
| 13 | | Ursula de Sousa | 400 | 225 | HM 10+50 | HM 14+50 | HM 10+25 | HM 12+50 | |
| 14 | | Joao Soares | 0 | 150 | | | HM 12+50 | HM 14+00 | |
| 15 | | Antao de Sousa | 0 | 47 | | | HM 14+00 | HM 14+47 | |
| 16 | | Salvador Gusmao | 175 | 0 | HM 14+50 | HM 16+25 | | | |
| 17 | | Marcelo Gusmao | 0 | 163 | | | HM 14+47 | HM 16+10 | |
| 18 | | Tomas Ximenes | 150 | 0 | HM 19+10 | HM 20+50 | | | |
| 19 | | Guilhermina Viegas | 0 | 290 | | | HM 16+10 | HM 19+00 | |
| 20 | | Unknown <i>Mario Gusmao</i> | 195 | 0 | HM 16+25 | HM 18+20 | | | |
| 21 | | Tomas Viegas | 80 | 0 | HM 18+20 | HM 19+10 | | | |
| 22 | | Mario Gusumao | 60 | 0 | HM 20+50 | HM 21+10 | | | |

A6 - 10

| | | | | | | | | |
|----|-----------------------|------|------|----------|----------|----------|----------|---|
| 22 | Simao Ximenes | 0 | 110 | | | HM 19+00 | HM 20+10 |  |
| 23 | Vitor Viegas | 0 | 190 | | | HM 20+10 | HM 22+00 | |
| 24 | Joao Kai Gusmao | 0 | 170 | | | HM 22+00 | HM 23+70 | |
| 25 | Pedro Gusmao | 150 | 0 | HM 22+00 | HM 23+50 | | | |
| 26 | Parish (Church) | 60 | 0 | HM 23+50 | HM 24+10 | | | |
| 27 | Filomena Diaz Ximenes | 65 | 90 | HM 24+10 | HM 24+75 | HM 23+70 | HM 24+60 | |
| 28 | Sebastiao Gusmao | 90 | 0 | HM 21+10 | HM 22+00 | | | |
| | | 25 | 0 | HM 24+75 | HM 25+00 | | | |
| 29 | Joao Viegas Malela | 0 | 40 | | | HM 24+60 | HM 25+00 | |
| | Total Distance | 2400 | 2400 | | | | | |

LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE SECONDARY CANAL NO.2 CONSTRUCTION

| No | Date | Name | Left side Distance (m) | Right side Distance (m) | Left side survey point | | Left side survey point | | Signature |
|----|------|------------------------------|------------------------|-------------------------|------------------------|---------|------------------------|---------|------------------|
| | | | | | | | | | |
| 1 | | Ursula de Sousa | 150 | 50 | HM 0+00 | HM 1+50 | HM 1+50 | HM 2+00 | <i>Ursula</i> |
| 2 | | Luis Soares | 0 | 150 | HM | HM | HM 0+00 | HM 1+50 | <i>Luis</i> |
| 3 | | Joao Alfredo de Sousa | 150 | 0 | HM 1+50 | HM 3+00 | HM | HM | <i>Joao</i> |
| 4 | | Antao de Sousa | 180 | 0 | HM 3+00 | HM 3+80 | HM | HM | <i>Antao</i> |
| 6 | | Alexandre de Sousa | 0 | 100 | HM | HM | HM 2+00 | HM 3+00 | <i>Alexandre</i> |
| 7 | | Maria Antonio de Sousa | 0 | 150 | HM | HM | HM 3+00 | HM 4+50 | <i>Maria</i> |
| 8 | | Francisco Alexandre de Sousa | 0 | 175 | HM | HM | HM 4+50 | HM 6+25 | <i>Francisco</i> |
| 9 | | Rita Ximenes Gusmao | 145 | 0 | HM 4+80 | HM 6+25 | | | <i>Rita</i> |
| 10 | | Miguel Gusmao | 0 | 125 | HM | HM | HM 6+25 | HM 7+50 | <i>Miguel</i> |
| 11 | | Joao Gusmao | 100 | 0 | HM 6+25 | HM 7+25 | HM | HM | <i>Joao</i> |
| 12 | | Francisco Alexandre Viegas | 35 | 0 | HM 7+25 | HM 7+60 | HM | HM | <i>Francisco</i> |
| 13 | | Carlito da Costa | 0 | 30 | HM | HM | HM 7+50 | HM 7+80 | <i>Carlito</i> |
| 14 | | Leki Mauk | 90 | 0 | HM 7+60 | HM 8+50 | HM | HM | <i>Leki</i> |
| 15 | | Vicente Gusmao Larus | 0 | 70 | HM | HM | HM 7+80 | HM 8+50 | <i>Vicente</i> |
| | | Total Distance | 850 | 850 | | | | | |

A6 - 12

LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE SECONDARY CANAL NO.3 CONSTRUCTION

| No | Date | Name | Left side Distance (m) | Right side Distance (m) | Left side survey point | | Left side survey point | | Signature |
|----|------|---------------------------|------------------------|-------------------------|------------------------|----------|------------------------|----------|--------------------|
| | | | | | | | | | |
| 14 | | Leki Mauk | 90 | 0 | HM 7+60 | HM 9+60 | HM | HM | <i>ck</i> |
| 15 | | Vicente Gusmao Larus | 0 | 90 | HM | HM | HM 7+80 | HM 9+60 | |
| 17 | | Joao Gusmao Chama | 230 | | HM 9+60 | HM 11+90 | HM | HM | <i>Joao Gusmao</i> |
| 18 | | Arsenio Viegas | 0 | 230 | HM | HM | HM 9+60 | HM 11+90 | <i>Arsenio</i> |
| 19 | | Simao Viegas | 140 | 0 | HM 11+90 | HM 13+30 | | | <i>Simao</i> |
| 20 | | Domingos Batista de Sousa | 0 | 110 | HM | HM | HM 11+90 | HM 13+00 | <i>Domingos</i> |
| 21 | | Vicente Boak | 0 | 30 | HM | HM | HM 13+00 | HM 13+30 | <i>Vicente</i> |
| 22 | | Manuel Viegas | 0 | 20 | HM | HM | HM 13+30 | HM 13+50 | <i>Manuel</i> |
| 23 | | Simao Viegas Mahunu | 20 | 0 | HM 13+30 | HM 13+50 | HM | HM | <i>Simao</i> |
| 24 | | Joao Viegas | 0 | 30 | HM | HM | HM 13+50 | HM 13+80 | <i>Joao</i> |
| 25 | | Franciseo Gusmao Metan | 40 | 0 | HM 13+50 | HM 13+90 | HM | HM | <i>Franciseo</i> |
| | | | 0 | 120 | HM | HM | HM 13+80 | HM 15+00 | |
| | | | 105 | 0 | HM 13+90 | HM 14+95 | HM | HM | |
| 26 | | Joao Gusmao Bohak | 0 | 60 | HM | HM | HM 15+00 | HM 15+60 | <i>Joao</i> |
| 27 | | Joao Gusmao Luan | 25 | 0 | HM 14+95 | HM 15+20 | HM | HM | <i>Joao</i> |
| 28 | | Jose Neru Gusmao | 180 | 140 | HM 15+20 | HM 17+00 | HM 15+60 | HM 17+00 | <i>Jose</i> |
| 29 | | Santana Ximenes | 100 | 100 | HM 17+00 | HM 18+00 | HM 17+00 | HM 18+00 | <i>Santana</i> |
| 30 | | Domingos Bento Viegas | 125 | 125 | HM 18+00 | HM 19+25 | HM 18+00 | HM 19+25 | <i>Domingos</i> |
| 31 | | Antonio Gusmao Nauh | 25 | 25 | HM 19+25 | HM 19+50 | HM 19+25 | HM 19+50 | <i>Antonio</i> |
| 32 | | Agapito Viegas | 20 | 20 | HM 19+50 | HM 19+70 | HM 19+50 | HM 19+70 | <i>Agapito</i> |
| 33 | | Cristina Viegas | 130 | 130 | HM 19+70 | HM 21+00 | HM 19+70 | HM 21+00 | <i>Cristina</i> |
| 34 | | Bernado Bere Ximenes | 160 | 150 | HM 21+00 | HM 22+50 | HM 21+00 | HM 22+50 | <i>Bernado</i> |
| | | Total Distance | 1390 | 1380 | | | | | |

* The number of the list of Land users' along Secondary No.3 is continuous of the list of Secondary No.2. It means this list includes all land users along Secondary No.3

A6 - 13

LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE SECONDARY CANAL NO.4 CONSTRUCTION

| No | Date | Name | Left side Distance (m) | Right side Distance (m) | Left side survey point | | Left side survey point | | Signature |
|----|------|------------------------------|------------------------|-------------------------|------------------------|----------|------------------------|----------|-------------|
| 1 | | Vicente dos Remedes de Sousa | 0 | 30 | | | HM 0+00 | HM 0+30 | VP VR |
| | | | 170 | 110 | HM 0+00 | HM 1+80 | HM 1+50 | HM 2+60 | |
| 2 | | Basildo Ximenes | 0 | 120 | | | HM 0+30 | HM 1+50 | [Signature] |
| | | | 90 | 0 | HM 5+00 | HM 5+90 | | | |
| 3 | | Manuel Ximenes | 80 | 0 | HM 1+80 | HM 2+60 | | | [Signature] |
| | | | 10 | 0 | HM 10+80 | HM 11+10 | | | |
| 4 | | Luis Viegas | 140 | 140 | HM 2+60 | HM 4+00 | HM 2+60 | HM 4+00 | [Signature] |
| 5 | | Leki Esak | 25 | 25 | HM 4+00 | HM 4+25 | HM 4+00 | HM 4+25 | [Signature] |
| 6 | | Na'uk Bambang da Costa | 75 | 75 | HM 4+25 | HM 5+00 | HM 4+25 | HM 5+00 | [Signature] |
| 7 | | Tome Ximenes | 0 | 80 | | | HM 5+00 | HM 5+80 | [Signature] |
| 8 | | Gaspar da Costa | 100 | 70 | HM 5+90 | HM 6+90 | HM 5+80 | HM 6+50 | [Signature] |
| 9 | | Jacinta da Costa | 0 | 160 | | | HM 6+50 | HM 8+10 | [Signature] |
| 10 | | Tomas Ximenes | 115 | 0 | HM 6+90 | HM 8+05 | HM | | [Signature] |
| 11 | | Jose Manuel da Costa | 25 | 0 | HM 8+05 | HM 8+30 | | | [Signature] |
| 12 | | Alexandre Lopes da Costa | 0 | 30 | | | HM 8+10 | HM 8+40 | [Signature] |
| 13 | | Antonio Ximenes | 80 | 0 | HM 8+30 | HM 9+10 | | | [Signature] |
| 14 | | Frederico Sanak | 0 | 90 | | | HM 8+40 | HM 9+30 | [Signature] |
| 15 | | Cosme Ximenes | 40 | 0 | HM 9+10 | HM 9+50 | | | [Signature] |
| 16 | | Seriaco da Costa | 0 | 40 | | | HM 9+30 | HM 9+70 | [Signature] |
| 17 | | Vicente Viegas | 5 | 0 | HM 9+50 | HM 9+55 | | | [Signature] |
| 18 | | Alberto Osak | 0 | 110 | | | HM 9+70 | HM 10+80 | [Signature] |
| 19 | | Joao Bosco Gusmao | 155 | 0 | HM 9+55 | HM 11+10 | | | [Signature] |

| | | | | | | | | |
|----|---------------------------|------|------|----------|----------|----------|----------|--|
| 20 | Luis Modo | 0 | 40 | | | HM 10+80 | HM 11+20 | |
| 21 | Paulo do rosario da Costa | 40 | 0 | HM 11+10 | HM 11+50 | | | |
| 22 | Francisco Loi | 0 | 105 | | | HM 11+20 | HM 12+25 | |
| 23 | Joao Bosco Gusmao | 300 | 0 | HM 11+50 | HM 14+50 | HM | HM | |
| 24 | Vicente da Costa | 0 | 200 | | | HM 12+25 | HM 14+25 | |
| 25 | Mario Assuncao Gusmao | 0 | 75 | | | HM 14+25 | HM 15+00 | |
| 26 | Ina Eve | 100 | 0 | HM 14+50 | HM 15+50 | | | |
| 27 | Jose Hendrique de Sousa | 0 | 58 | | | HM 15+00 | HM 15+58 | |
| 28 | Tome Domingos de Sousa | 8 | 0 | HM 15+50 | HM 15+58 | | | |
| | Total Distance | 1558 | 1558 | | | | | |

LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE SECONDARY CANAL NO.5 CONSTRUCTION

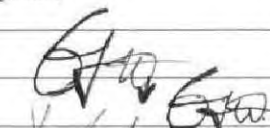

| No | Date | Name | Left side Distance (m) | Right side Distance (m) | Left side survey point | | Left side survey point | | Signature |
|-----|------|--------------------------|------------------------|-------------------------|------------------------|----------|------------------------|----------|--------------------|
| | | | | | HM | HM | HM | HM | |
| 1 | | Jose Hendrique de Sousa | 170 | 0 | HM 0+00 | HM 1+70 | HM | HM | <i>[Signature]</i> |
| 2 | | Tome Domingos de Sousa | 0 | 130 | HM | HM | HM 0+00 | HM 1+30 | <i>[Signature]</i> |
| ✓ 3 | | Manuel Ximenes Ta'an | 90 | 0 | HM 1+70 | HM 2+60 | HM | HM | <i>[Signature]</i> |
| 4 | | Francisco da Costa Metan | 0 | 130 | HM | HM | HM 1+30 | HM 2+60 | <i>[Signature]</i> |
| 5 | | Costorio de Sousa | 210 | 0 | HM 2+60 | HM 4+70 | HM | HM | <i>[Signature]</i> |
| 6 | | Joao Luca Soares | 0 | 160 | HM | HM | HM 2+60 | HM 4+20 | <i>[Signature]</i> |
| ✓ 7 | | Cosme Ximenes | 0 | 60 | HM | HM | HM 4+20 | HM 4+80 | <i>[Signature]</i> |
| 8 | | Maladis | 90 | 0 | HM 4+70 | HM 5+60 | HM | HM | <i>[Signature]</i> |
| | | | 23 | 0 | HM 10+60 | HM 10+83 | HM | HM | |
| 9 | | Ambesi Luruk | 0 | 110 | HM | HM | HM 4+80 | HM 5+90 | <i>[Signature]</i> |
| 10 | | Vital Liban | 310 | 0 | HM 5+60 | HM 8+70 | HM | HM | <i>[Signature]</i> |
| 11 | | Jose Capitao | 0 | 80 | HM | HM | HM 5+90 | HM 6+70 | <i>[Signature]</i> |
| 12 | | Jose Hendriques | 0 | 30 | HM | HM | HM 6+70 | HM 7+00 | <i>[Signature]</i> |
| 13 | | Jacinto Coli | 0 | 300 | HM | HM | HM 7+00 | HM 10+00 | <i>[Signature]</i> |
| 14 | | Sebastiao da Costa | 190 | 0 | HM 8+70 | HM 10+60 | HM | HM | <i>[Signature]</i> |
| 15 | | Joao Coli | 0 | 60 | HM | HM | HM 10+00 | HM 10+60 | <i>[Signature]</i> |
| 16 | | Vicente Pereira | 0 | 23 | HM | HM | HM 10+60 | HM 10+83 | <i>[Signature]</i> |
| | | Total Distance | 1083 | 1083 | | | | | |

A6 - 16

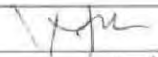



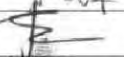


LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE SECONDARY CANAL NO.6 CONSTRUCTION

| No | Date | Name | Left side Distance (m) | Right side Distance (m) | Left side survey point | | Left side survey point | | Signature |
|----|------|------------------|------------------------|-------------------------|------------------------|---------|------------------------|---------|-----------|
| | | | | | | | | | |
| 1 | | Jose Correia | 0 | 140 | HM | HM | HM 0+00 | HM 1+40 | |
| 2 | | Policia Mano | 240 | 110 | HM 0+00 | HM 2+40 | HM 1+40 | HM 2+50 | |
| 3 | | Domingos Soares | 40 | 0 | HM 2+40 | HM 2+80 | HM | HM | |
| 4 | | Domingos Freitas | 0 | 138 | HM | HM | HM 2+50 | HM 3+88 | |
| 5 | | Joao Simu | 108 | 0 | HM 2+80 | HM 3+88 | HM | HM | |
| | | Total Distance | 388 | 388 | | | | | |

LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE SECONDARY CANAL NO.7 CONSTRUCTION

| No | Date | Name | Left side Distance (m) | Right side Distance (m) | Left side survey point | | Left side survey point | | Signature |
|----|------|-------------------|------------------------|-------------------------|------------------------|---------|------------------------|---------|---|
| | | | | | | | | | |
| 1 | | Hermegildo Maukai | 65 | 370 | HM 0+00 | HM 0+65 | HM 0+00 | HM 3+70 |  |
| | | | 80 | 0 | HM 0+65 | HM 1+45 | | | |
| 2 | | Alexandre Freitas | 225 | 0 | HM 1+45 | HM 1+65 | HM | HM |  |
| 3 | | Domingos Captao | 25 | 0 | HM 3+70 | HM 3+95 | HM | HM | |
| 4 | | Egidio Correia | 0 | 70 | HM | HM | HM 3+70 | HM 4+40 | |
| 5 | | Elias Freitas | 127 | 0 | HM 3+95 | HM 5+22 | HM | HM | |
| 6 | | Rui Carlos | 0 | 30 | HM | HM | HM 4+40 | HM 4+70 | |
| 7 | | Jose Correia | 0 | 52 | HM | HM | HM 4+70 | HM 5+22 | |
| | | Total Distance | 522 | 522 | | | | | |

LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE SECONDARY CANAL NO.8 CONSTRUCTION

| No | Date | Name | Left side Distance (m) | Right side Distance (m) | Left side survey point | | Left side survey point | | Signature |
|----|------|-----------------|------------------------|-------------------------|------------------------|----------|------------------------|----------|---|
| | | | | | HM 15+50 | HM 16+30 | HM | HM | |
| 1 | | Vitor da Silva | 80 | 0 | HM 15+50 | HM 16+30 | HM | HM |  |
| 2 | | Feliciano Dehak | | 80 | HM | HM | HM 15+50 | HM 16+30 |  |
| 3 | | Antonio Karlele | 180 | 180 | HM 16+30 | HM 18+10 | HM 16+30 | HM 18+10 |  |
| 4 | | Vitor Freitas | 140 | 140 | HM 18+10 | HM 19+50 | HM 18+10 | HM 19+50 |  |
| 5 | | Julio Correia | 45 | 50 | HM 19+50 | HM 19+95 | HM 19+50 | HM 19+95 |  |
| 6 | | Jacinto Coli | 5 | 0 | HM 19+95 | HM 20+00 | HM | HM |  |
| 7 | | Leonardo Metan | 100 | 100 | HM 20+00 | HM 21+00 | HM 19+95 | HM 21+00 |  |
| | | Total Distance | 550 | 550 | | | | | |

LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE SECONDARY CANAL NO.9 CONSTRUCTION

| No | Date | Name | Left side Distance (m) | Right side Distance (m) | Left side survey point | | Left side survey point | | Signature |
|----|------|-------------------|------------------------|-------------------------|------------------------|----------|------------------------|----------|--------------------|
| | | | | | HM 0 | HM 0+80 | HM 0+00 | HM 1+00 | |
| 1 | | Hermegildo Maukai | 80 | 100 | HM 0 | HM 0+80 | HM 0+00 | HM 1+00 | <i>[Signature]</i> |
| 2 | | Maria do Ceo | 170 | 0 | HM 0+80 | HM 2+50 | HM | HM | <i>[Signature]</i> |
| 3 | | Lamberto Freitas | 0 | 110 | HM | HM | HM 1+00 | HM 2+10 | <i>[Signature]</i> |
| 4 | | Egídio Correia | 150 | 170 | HM 2+50 | HM 4+00 | HM 2+10 | HM 3+80 | <i>[Signature]</i> |
| 5 | | Teotonio Freitas | 40 | 135 | HM 4+00 | HM 4+40 | HM 3+80 | HM 5+15 | <i>[Signature]</i> |
| 6 | | Domingos Ikun | 210 | 135 | HM 4+40 | HM 6+50 | HM 5+15 | HM 6+50 | <i>[Signature]</i> |
| 7 | | Maskai | 248 | 70 | HM 6+50 | HM 8+25 | HM 6+50 | HM 7+20 | <i>[Signature]</i> |
| 8 | | Martinho Freitas | 0 | 155 | HM | HM | HM 7+20 | HM 8+75 | <i>[Signature]</i> |
| 9 | | Joao Maduan | 0 | 23 | HM | HM | HM 8+75 | HM 8+98 | <i>[Signature]</i> |
| 10 | | Cosme Freitas | 0 | 141 | HM | HM | HM 8+98 | HM 10+39 | <i>[Signature]</i> |
| 11 | | Inakita Ximenes | 82 | 0 | HM 8+98 | HM 9+80 | HM | HM | <i>[Signature]</i> |
| 12 | | Julio Correia | 59 | 0 | HM 9+80 | HM 10+39 | HM | HM | <i>[Signature]</i> |
| | | Total Distance | 1039 | 1039 | | | | | |

LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE SECONDARY CANAL NO.10 CONSTRUCTION

| No | Date | Name | Left side Distance (m) | Right side Distance (m) | Left side survey point | | Left side survey point | | Signature |
|----|------|-----------------|------------------------|-------------------------|------------------------|---------|------------------------|---------|--------------------|
| 1 | | Government | 453 | 453 | | | | | - |
| 2 | | Comes da sousa | 110 | 60 | HM 0+60 | HM 1+70 | HM 0+00 | HM 0+60 | <i>[Signature]</i> |
| 3 | | Afonso Soares | 60 | 0 | HM 0+00 | HM 0+60 | HM | HM | <i>[Signature]</i> |
| 4 | | Finomena Viegas | 0 | 110 | HM | HM | HM 0+60 | HM 1+70 | <i>[Signature]</i> |
| | | Total Distance | 623 | 623 | | | | | |

LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE SECONDARY CANAL NO.12 CONSTRUCTION

| No | Date | Name | Left side Distance (m) | Right side Distance (m) | Left side survey point | | Left side survey point | | Signature |
|----|------|----------------------------|------------------------|-------------------------|------------------------|----------|------------------------|----------|------------|
| | | | | | | | | | |
| 1 | | Domingos Ramos Correia | 175 | 0 | HM 0+00 | HM 1+75 | HM | HM | <i>DRC</i> |
| 2 | | Rui Manuel Freitas | 0 | 70 | HM | HM | HM 0+00 | HM 0+70 | <i>RMF</i> |
| 3 | | Francisco Freitas | 0 | 55 | HM | HM | HM 0+70 | HM 1+25 | <i>FF</i> |
| 4 | | Jose Fernando Correia | 0 | 125 | HM | HM | HM 1+25 | HM 2+50 | <i>JFC</i> |
| 5 | | Joao da Costa Freitas | 200 | 145 | HM 1+75 | HM 3+75 | HM 2+50 | HM 3+95 | <i>JCF</i> |
| 6 | | Silberio Freitas | 45 | 5 | HM 3+75 | HM 4+20 | HM 3+95 | HM 4+00 | <i>SF</i> |
| 7 | | Domingos Ramos Correia | 0 | 20 | HM | HM | HM 4+00 | HM 4+20 | <i>DRC</i> |
| 8 | | Inicencio | 0 | 80 | HM | HM | HM 4+20 | HM 5+00 | <i>I</i> |
| 9 | | Jose Freitas | 280 | 0 | HM 4+20 | HM 7+00 | HM | HM | <i>JF</i> |
| 10 | | Domingos Guterres | 0 | 80 | HM | HM | HM 5+00 | HM 5+80 | <i>DG</i> |
| 11 | | Marcel Faria | 0 | 30 | HM | HM | HM 5+80 | HM 6+10 | <i>M</i> |
| 12 | | Marcelino Bosi Oro | 0 | 70 | HM | HM | HM 6+10 | HM 6+80 | <i>MBO</i> |
| 13 | | Jose Fernando Correia | 0 | 20 | HM | HM | HM 6+80 | HM 7+00 | <i>JFC</i> |
| 14 | | Joao Gusmao | 0 | 120 | HM | HM | HM 7+00 | HM 8+20 | <i>JG</i> |
| 15 | | Francisco Alexandre Viegas | 100 | 0 | HM 7+00 | HM 8+00 | HM | HM | <i>FV</i> |
| 16 | | Carlito da Costa | 220 | 0 | HM 8+00 | HM 10+20 | HM | HM | <i>CD</i> |
| 17 | | Carlito da Costa | 0 | 230 | HM | HM | HM 8+20 | HM 10+50 | <i>CD</i> |
| 18 | | Rui Manuel Freitas | 100 | 0 | HM 10+20 | HM 11+20 | HM | HM | <i>RMF</i> |
| 19 | | Inicencio | 60 | 0 | HM 11+20 | HM 11+80 | HM | HM | <i>I</i> |
| 20 | | Silberio Freitas | 20 | 0 | HM 11+80 | HM 12+00 | HM | HM | <i>SF</i> |

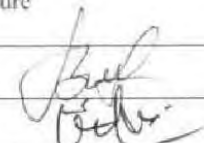
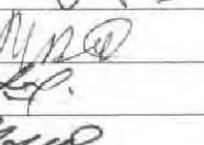
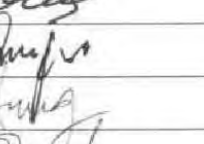
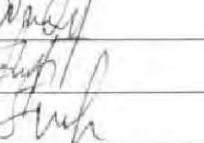
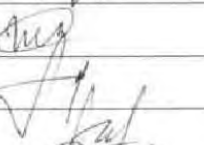
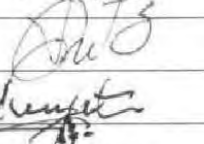
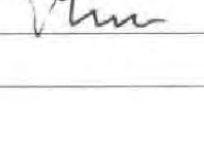



| | | | | | | | | |
|----|-----------------------|------|------|----------|----------|----------|----------|------------------------------|
| 21 | Vitor Viegas | 50 | 0 | HM 12+00 | HM 12+50 | HM | HM | <i>Vitor Viegas</i> |
| 22 | Joao Kai Gusmao | 10 | 0 | HM 12+50 | HM 12+60 | HM | HM | <i>Joao Kai Gusmao</i> |
| 23 | Pedro Gusmao | 40 | 0 | HM 12+60 | HM 13+00 | HM | HM | <i>Pedro Gusmao</i> |
| 24 | Andre Gusmao | 0 | 40 | HM | HM | HM 10+50 | HM 10+90 | <i>Andre Gusmao</i> |
| 25 | Jastin da Costa | 30 | 0 | HM 13+00 | HM 13+30 | HM | HM | <i>Jastin da Costa</i> |
| 26 | Filomena Diaz Ximenes | 0 | 10 | HM | HM | HM 10+90 | HM 11+00 | <i>Filomena Diaz Ximenes</i> |
| 27 | Sebastiao Gusmao | 0 | 100 | HM | HM | HM 11+00 | HM 12+00 | <i>Sebastiao Gusmao</i> |
| 28 | Francisco Freitas | 0 | 120 | HM | HM | HM 12+00 | HM 13+20 | <i>Francisco Freitas</i> |
| 29 | Tomas Masai | 0 | 10 | HM | HM | HM 13+20 | HM 13+10 | <i>Tomas Masai</i> |
| | Total Distance | 1330 | 1330 | | | | | |

LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE SECONDARY CANAL NO.13 CONSTRUCTION

| No | Date | Name | Left side Distance (m) | Right side Distance (m) | Left side survey point | | Left side survey point | | Signature |
|----|------|-----------------------|------------------------|-------------------------|------------------------|----------|------------------------|----------|-------------------------|
| | | | | | | | | | |
| 1 | | Leopoldo Freitas | 0 | 260 | | | HM 0+00 | HM 2+60 | <i>Leop</i> |
| 2 | | Felisarda Viegas | 200 | 0 | HM 0+00 | HM 2+00 | | | <i>Felisarda Viegas</i> |
| 3 | | Joao da Costa Freitas | 50 | 0 | HM 2+00 | HM 2+50 | | | |
| 4 | | Jose Fernando Correia | 70 | 0 | HM 2+50 | HM 3+20 | | | |
| 5 | | Gastao Soares | 0 | 120 | | | HM 2+60 | HM 3+80 | <i>João -</i> |
| 6 | | Maudara Correia | 996 | 936 | HM 3+20 | HM 13+16 | HM 3+80 | HM 13+16 | <i>Ambr</i> |
| | | Total Distance | 1316 | 1316 | | | | | |






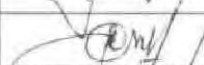
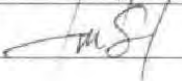
A6 - 24

LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE SECONDARY CANAL NO.14 CONSTRUCTION

| No | Date | Name | Left side Distance (m) | Right side Distance (m) | Left side survey point | | Left side survey point | | Signature |
|----|------|----------------------|------------------------|-------------------------|------------------------|---------|------------------------|----------|---|
| | | | | | HM | HM | HM | HM | |
| 1 | | Beto Kai | 160 | 125 | HM 0+50 | HM 1+20 | HM 0+00 | HM 0+125 |  |
| 2 | | Vitor da Silva | 50 | 0 | HM 0+00 | HM 0+50 | | |  |
| 3 | | Marcelino Bosi Oro | 0 | 225 | | | HM 1+25 | HM 3+50 |  |
| 4 | | Jose Uma Kalen | 140 | 0 | HM 2+10 | HM 3+50 | | |  |
| 5 | | Inicencio | 95 | 0 | HM 3+50 | HM 4+45 | | |  |
| 6 | | Justino | 0 | 95 | | | HM 3+50 | HM 4+45 |  |
| 7 | | Andre Gusmao | 35 | 0 | HM 4+45 | HM 4+80 | | |  |
| 8 | | Constancio Freitas | 0 | 75 | | | HM 4+45 | HM 5+20 |  |
| 9 | | Agusto (Infermeiro) | 295 | 0 | HM 4+80 | HM 7+75 | | |  |
| 10 | | Sancho | 0 | 10 | | | HM 5+20 | HM 5+30 |  |
| 11 | | Inacio | 0 | 90 | | | HM 5+30 | HM 6+20 | |
| 12 | | Jose Freitas | 0 | 110 | | | HM 6+20 | HM 7+30 | |
| 13 | | Joao de Fatima Seran | 0 | 70 | | | HM 7+30 | HM 8+00 | |
| 14 | | Guilherme Soares | 85 | 0 | HM 7+75 | HM 8+60 | | | |
| 15 | | Domingos Guterres | 0 | 188 | | | HM 8+00 | HM 9+88 | |
| 16 | | Daniel Soares | 128 | 0 | HM 8+60 | HM 9+88 | | | |
| | | Total Distance | 988 | 988 | | | | | |

A6 - 25

LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE SECONDARY CANAL NO.15 CONSTRUCTION

| No | Date | Name | Left side Distance (m) | Right side Distance (m) | Left side survey point | | Left side survey point | | Signature |
|----|------|--------------------|------------------------|-------------------------|------------------------|---------|------------------------|---------|---|
| | | | | | HM 0+00 | HM 3+25 | HM 0+00 | HM 0+90 | |
| 1 | | Leopoldo Freitas | 325 | 90 | HM 0+00 | HM 3+25 | HM 0+00 | HM 0+90 |  |
| 2 | | Manuel Diogo | 0 | 315 | | | HM 0+90 | HM 4+05 |  |
| 3 | | Tomas Masai | 231 | 0 | HM 3+25 | HM 5+56 | | |  |
| 4 | | Tolomeu | 0 | 135 | | | HM 4+05 | HM 5+40 |  |
| 5 | | Jose da Silva | 0 | 60 | | | HM 5+40 | HM 6+00 |  |
| 6 | | Constancio Freitas | 94 | 0 | HM 5+56 | HM 6+50 | | |  |
| 7 | | Fernando da Silva | 0 | 50 | | | HM 6+00 | HM 6+50 |  |
| | | Total Distance | 650 | 650 | | | | | |

LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE SECONDARY CANAL NO.16 CONSTRUCTION

| No | Date | Name | Left side Distance (m) | Right side Distance (m) | Left side survey point | | Left side survey point | | Signature |
|----|------|-----------------------|------------------------|-------------------------|------------------------|---------|------------------------|---------|--------------------|
| 1 | | Domingos Leki Freitas | 0 | 200 | | | HM 0+00 | HM 2+00 | <i>[Signature]</i> |
| 2 | | Alberto da Silva | 200 | 50 | HM 0+00 | HM 2+00 | HM 2+00 | HM 2+50 | <i>[Signature]</i> |
| 3 | | Domingos Leki Freitas | 50 | 160 | HM 2+00 | HM 2+50 | HM 2+50 | HM 4+10 | <i>[Signature]</i> |
| 4 | | Ricardo da Silva | 45 | 0 | HM 2+50 | HM 9+95 | | | <i>[Signature]</i> |
| 5 | | Filomeno Freitas | 160 | 0 | HM 9+95 | HM 4+55 | | | <i>[Signature]</i> |
| 6 | | Estevo Freitas | 95 | 140 | HM 4+55 | HM 5+50 | HM 4+10 | HM 5+50 | <i>[Signature]</i> |
| 7 | | Alberto da Silva | 25 | 0 | HM 5+50 | HM 5+75 | | | <i>[Signature]</i> |
| 8 | | Joana Freitas | 25 | 0 | HM 5+75 | HM 6+00 | | | <i>[Signature]</i> |
| 9 | | Tomas Freitas | 55 | 50 | HM 6+00 | HM 6+55 | HM 5+50 | HM 6+00 | <i>[Signature]</i> |
| 10 | | Filomeno Freitas | 0 | 55 | | | HM 6+00 | HM 6+55 | <i>[Signature]</i> |
| 11 | | Bartolomeu da Silva | 10 | 10 | HM 6+55 | HM 6+65 | HM 6+55 | HM 6+65 | <i>[Signature]</i> |
| | | Total Distance | 665 | 665 | | | | | |

A6 - 27

3. Drainage Canals

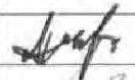

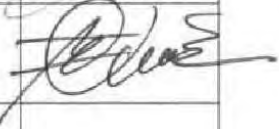
Result of Survey for Land Acquisition

A. LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE DRAIN CANAL NO.1 CONSTRUCTION

| No | Date | Name | Left side Distance(m) | Right side Distance (m) | Left side | | Right side | | Land use | Signature |
|----|------|------------------------------|---------------------------|----------------------------|--------------|--------------|--------------|--------------|-----------------------------------|--------------------|
| | | | | | survey point | survey point | survey point | survey point | | |
| 1 | | Joanieo Paicheco | 200 | 320 | 0+00 | 2+00 | 0+00 | 3+20 | Farm Land | <i>[Signature]</i> |
| 2 | | Agusto Freitas | 120 | 0 | 2+00 | 3+20 | | | Farm Land | <i>[Signature]</i> |
| 3 | | Constancio Freitas | 50 | 0 | 3+20 | 3+70 | | | Farm Land | <i>[Signature]</i> |
| 4 | | Lamberto Freitas | 0 | 150 | | | 3+20 | 4+70 | Farm Land | <i>[Signature]</i> |
| 5 | | Martinho Freitas | 90 | 0 | 3+70 | 4+60 | | | Farm Land | <i>[Signature]</i> |
| 6 | | Simao Soares | 0 | 170 | | | 4+70 | 6+40 | Farm Land | <i>[Signature]</i> |
| 7 | | Church Parish | 180 | 0 | 4+60 | 6+40 | | | Farm Land | <i>[Signature]</i> |
| 8 | | Amino Soares | 0 | 70 | | | 6+40 | 7+10 | Farm Land | <i>[Signature]</i> |
| 9 | | Antonio Baha Batu | 170 | 0 | 6+40 | 8+10 | | | Farm Land | <i>[Signature]</i> |
| 10 | | Feliciano Dehak | 230 | 0 | 8+10 | 10+40 | | | Farm Land | <i>[Signature]</i> |
| 11 | | Antonio Karlele | 0 | 500 | | | 7+10 | 12+10 | Farm Land | <i>[Signature]</i> |
| 12 | | Vitor | 220 | 0 | 10+40 | 12+60 | | | Farm Land | <i>[Signature]</i> |
| 13 | | Julio Correia | 40 | 0 | 12+60 | 13+00 | | | Farm Land | <i>[Signature]</i> |
| 14 | | Jacinto Coli | 130 | 0 | 13+00 | 14+30 | | | Farm Land | <i>[Signature]</i> |
| 15 | | Leonardo Metan | 20 | 240 | 14+30 | 14+50 | 12+10 | 14+50 | Farm Land | <i>[Signature]</i> |
| 16 | | Gaspar Makasa | 662 | 662 | 14+50 | 21+12 | 14+50 | 21+12 | Potential land for agriculture | <i>[Signature]</i> |
| 17 | | Carlos Freitas (Suco Leader) | 239 | 239 | 21+12 | 23+51 | 21+12 | 23+51 | Swamp area (Natural) | <i>[Signature]</i> |
| | | Total Distance | 2,351 | 2,351 | | | | | | |


Result of Survey for Land Acquisition

B. LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE DRAIN CANAL NO.2 CONSTRUCTION

| No | Date | Name | Left side Distance(m) | Right side Distance (m) | Left side survey point | | Right side survey point | | Land use | Signature |
|----|------|------------------------------|---------------------------|----------------------------|---------------------------|-------|----------------------------|-------|-------------------------|---|
| | | | | | | | | | | |
| 1 | | Maudara Correia | | 30 | | | 0+00 | 0+30 | Farm Land |  |
| 2 | | Elias Soares | 882 | 852 | 0+00 | 8+82 | 0+30 | 8+82 | Farm Land |  |
| 3 | | Carlos Freitas (Suco Leader) | 763 | 763 | 8+82 | 16+45 | 8+82 | 16+45 | Swamp area (Natural) |  |
| | | Total Distance | 1645 | 1645 | | | | | | |

4. WUA Meeting Facilities



| No | Date | Name | Land use | Signature |
|----|------|------------------------------|-----------------------|---|
| 1 | | Carlos Freitas (Suco Leader) | Waste Land (0.5ha) |  |
| | | | | |
| | | | | |



5. Felling Trees

Survey Result of kind and number of tree for Felling Trees

(Unit: Number of tree)

1. Left Side of Proposed Weir

| Date | Area(m2) | Name of Land User | Kind and number of tree | | | | Signature |
|------|----------|---------------------|-------------------------|-----------|------|---------|------------|
| | | | Ai kakeu | Ai haneki | Kulu | Herotak | |
| | 15,000 | Antonio Viegas Huno | 30 | 60 | 15 | 30 | <i>AVH</i> |
| | | | | | | | |
| | | | | | | | |

2. Right Side of Proposed Weir

(Unit: Number of tree)

| Date | Area (m2) | Name of Land User | Kind and number of tree | | | | Signature |
|------|-----------|--------------------|-------------------------|-----------|------|---------|------------------|
| | | | Ai kakeu | Ai haneki | Kulu | Herotak | |
| | 34,500 | Domingos de Araujo | 690 | 1380 | 345 | 690 | <i>D. Araujo</i> |
| | | | | | | | |
| | | | | | | | |

3. Proposed River Protection Dike on the Right Bank

(Unit: Number of tree)

| Date | Area (m2) | Name of Land User | Kind and number of tree | | | | Signature |
|-------|-----------|--------------------|-------------------------|-----------|------|---------|------------------|
| | | | Ai kakeu | Ai haneki | Kulu | Herotak | |
| | 3,75 | Domingos de Araujo | 76 | 152 | 38 | 76 | <i>D. Araujo</i> |
| | 11,00 | Kaisai | 161 | 323 | 80 | 161 | <i>S. Soares</i> |
| | | | | | | | |
| | | | | | | | |
| Total | 11,875 | | 237 | 475 | 118 | 237 | |





4. Proposed River Protection Dike on the Left Bank

(Unit: Number of tree)

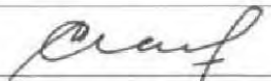

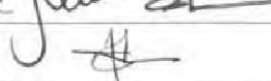
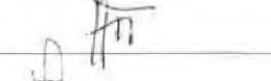





| Date | Area (m2) | Name of Land User | Kind and number of tree | | | | Signature |
|------|-----------|--------------------------|-------------------------|-----------|------|---------|------------------|
| | | | Ai kakeu | Ai haneki | Kulu | Herotak | |
| | 2,315 | Miguel do Rosario Soares | 46 | 92 | 23 | 46 | <i>M. Soares</i> |
| | | | | | | | |
| | | | | | | | |

5. Period from Beginning Point (BP) to "1+090"

(Unit: Number of tree)

| Date | Area(m2) | Name of Land User | Kind and number of tree | | | | Signature |
|------|----------|----------------------|-------------------------|-----------|------|---------|---|
| | | | Ai kakeu | Ai haneki | Kulu | Herotak | |
| | 3,420 | Domingos de Araujo | 68 | 136 | 34 | 68 |  |
| | 4,500 | Joao Gusumao | 90 | 180 | 45 | 90 |  |
| | 2,250 | Tomas Amaral Ximenes | 44 | 88 | 22 | 44 |  |
| | 3,300 | Agustinho Gusumao | 66 | 132 | 33 | 66 |  |
| | | | | | | | |
| | Total | | 268 | 536 | 134 | 268 | |

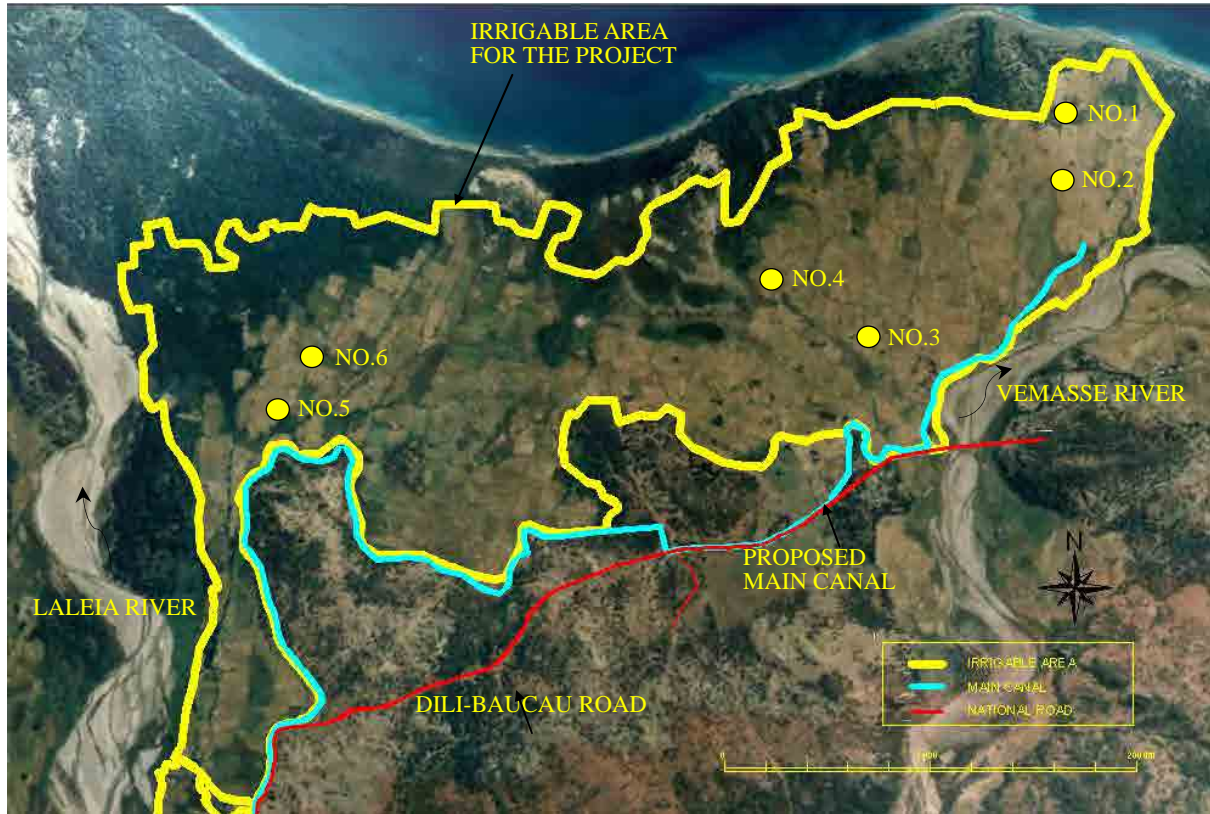
LIST OF LANDUSERS NEEDING LAND ACQUISITION DUE TO THE SECONDARY CANAL NO.11 CONSTRUCTION

| No | Date | Name | Left side Distance (m) | Right side Distance (m) | Left side survey point | | Left side survey point | | Signature |
|----|------|--------------------------|------------------------|-------------------------|------------------------|---------|------------------------|---------|---|
| | | | | | | | | | |
| 1 | | Cosme Freitas | 20 | 10 | HM 0.00 | HM 0.20 | HM 0.00 | HM 0.10 |  |
| 2 | | Januario Freitas | | 15 | | | HM 0.10 | HM 0.25 |  |
| 3 | | João Agostinho Freitas | | 10 | | | HM 0.25 | HM 0.35 |  |
| 4 | | João Freitas | | 15 | | | HM 0.35 | HM 0.50 |  |
| 5 | | Felisarda Viegas Freitas | 30 | | HM 0.20 | HM 0.50 | | |  |
| 6 | | Agusto Freitas | 25 | | HM 0.50 | HM 0.75 | | |  |
| 7 | | Paulino Soares | | 25 | | | HM 0.50 | HM 0.75 |  |
| 8 | | Ana Rosalia Soares | | 25 | | | HM 0.75 | HM 100 |  |
| 9 | | Pedro Freitas | 25 | | HM 0.75 | HM 100 | | |  |
| | | Total distance | 100 | 100 | | | | | |

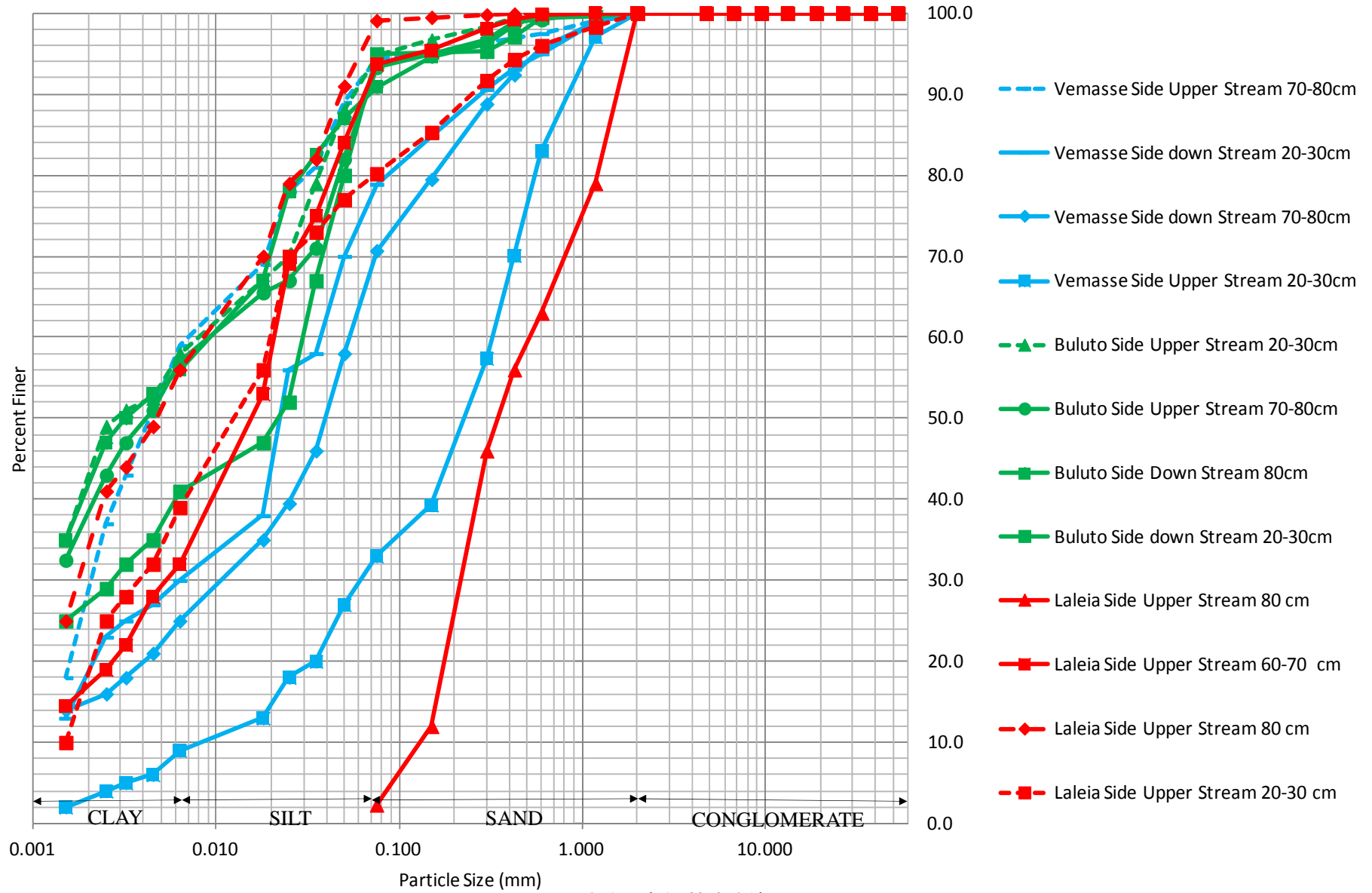
A6 - 33

資料 7 粒度分析調査

(1) 受益地内土質試験（テストピット）結果



| | 礫 | 砂 | | | | | | | シルト | | | | | 粘土 | | | | |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--|
| | >4.75 | 2.00 | 1.18 | 0.600 | 0.425 | 0.300 | 0.150 | 0.075 | 0.050 | 0.035 | 0.0250 | 0.0180 | 0.0063 | 0.0045 | 0.0032 | 0.0025 | 0.0015 | |
| 1 | 100.0 | 100.0 | 98.9 | 95.6 | 92.4 | 88.8 | 79.5 | 70.7 | 58.0 | 46.0 | 39.5 | 35.0 | 25.0 | 21.0 | 18.0 | 16.0 | 14.0 | |
| 2 | 100.0 | 100.0 | 99.6 | 99.5 | 97.1 | 95.3 | 95.2 | 95.0 | 80.0 | 67.0 | 52.0 | 47.0 | 41.0 | 35.0 | 32.0 | 29.0 | 25.0 | |
| 3 | 100.0 | 100.0 | 99.9 | 99.7 | 99.4 | 98.3 | 96.7 | 94.7 | 88.0 | 79.0 | 70.0 | 67.0 | 58.0 | 52.5 | 51.0 | 49.0 | 35.0 | |
| 4 | 100.0 | 100.0 | 100.0 | 99.8 | 99.2 | 98.1 | 95.4 | 93.7 | 84.0 | 75.0 | 69.0 | 53.0 | 32.0 | 28.0 | 22.0 | 19.0 | 14.5 | |
| 5 | 100.0 | 100.0 | 97.1 | 83.0 | 70.1 | 57.4 | 39.3 | 33.0 | 27.0 | 20.0 | 18.0 | 13.0 | 9.0 | 6.0 | 5.0 | 4.0 | 2.0 | |
| 6 | 100.0 | 100.0 | 99.9 | 99.2 | 98.8 | 96.7 | 95.0 | 93.3 | 82.0 | 71.0 | 67.0 | 65.5 | 57.0 | 51.0 | 47.0 | 43.0 | 32.5 | |
| 7 | 100.0 | 100.0 | 99.9 | 99.7 | 98.6 | 96.2 | 94.6 | 90.9 | 87.0 | 82.5 | 78.0 | 67.0 | 56.0 | 53.0 | 50.0 | 47.0 | 35.0 | |
| 8 | 100.0 | 100.0 | 99.0 | 97.5 | 96.9 | 96.3 | 95.2 | 94.4 | 89.0 | 81.0 | 78.0 | 69.0 | 59.0 | 51.0 | 43.0 | 37.0 | 18.0 | |
| 9 | 100.0 | 100.0 | 98.8 | 95.0 | 93.1 | 90.6 | 84.8 | 78.9 | 70.0 | 58.0 | 56.0 | 38.0 | 30.0 | 27.0 | 25.0 | 23.0 | 13.0 | |
| 10 | 100.0 | 100.0 | 99.9 | 99.9 | 99.9 | 99.8 | 99.5 | 99.1 | 91.0 | 82.0 | 79.0 | 70.0 | 56.0 | 49.0 | 44.0 | 41.0 | 25.0 | |
| 11 | 100.0 | 100.0 | 98.3 | 96.0 | 94.3 | 91.7 | 85.3 | 80.2 | 77.0 | 73.0 | 70.0 | 56.0 | 39.0 | 32.0 | 28.0 | 25.0 | 10.0 | |
| 12 | 100.0 | 100.0 | 79.0 | 63.0 | 56.0 | 46.0 | 12.0 | 2.3 | | | | | | | | | | |



受益地内都質試験結果



P.O. Box 130, Camero River Road, Dili, East Timor
 Tel. 001 670 3 313813, Fax. 0011 6703 312407
 Email: info@rmsende.com.au
 Web Site: www.rmsende.com.au

MATERIALS TESTING CENTRE

| GRAIN - SIZE ANALYSIS (HYDROMETER METHOD) REPORT | | | | | | | | | |
|--|------------------------|-------------------------------|--|-----------|---|---------------------------------------|---------------------------|---------------|-----------|
| PROJECT: VEMASSE RIVER | | | LOCATION: Vemasse | | | DATE: 11-Dec-12 | | | |
| COORDINATES: Soi (20-30cm) East down No.1 | | | SAMPLE SPECIMEN: Soi (20-30cm) East No.1 | | | CLASSIFICATION: | | | |
| DISH NUMBER: 01 | | | CYLINDER ID: 01 | | | HYDROMETER TYPE (151H/152H): 152H | | | |
| DISPERSING AGENT USED: sodium hexametaphosphate | | | QUANTITY: 125mL at 40g/L solution | | | COMPOSITE CORRECTION: See calibration | | | |
| DECIMAL FINES: 1 (00) | | | 8% GR. OF SOLIDS, 80 = 2.73 | | | | | | |
| Time (Minutes) | ELAPSED TIME (Minutes) | ACTUAL HYDROMETER READING (R) | CORRECTED READING (R) | TEMP (°C) | TEMPERATURE AND SPECIFIC GRAVITY CONSTANT (K) | EFFECTIVE DEPTH (L) | PARTICLE DIAMETER (D), mm | PERCENT FINER | |
| | | | | | | | | (A) Partial | (B) Total |
| Start | 12:55 | - | - | - | - | - | - | - | - |
| 1 | 13:51 | 37 | 24 | 20 | 0.01544 | 12.4 | 0.047 | 47.32 | 47.5 |
| 2 | 13:55 | 28 | 20 | 20 | 0.01544 | 13.0 | 0.0343 | 39.6 | 35.6 |
| 3 | 14:00 | 26 | 16 | 20 | 0.01544 | 13.3 | 0.0220 | 25.64 | 31.6 |
| 15 | 14:10 | 24 | 16 | 20 | 0.01544 | 13.7 | 0.0128 | 11.68 | 31.7 |
| 30 | 14:20 | 22 | 14 | 20 | 0.01544 | 14.0 | 0.0092 | 7.72 | 27.7 |
| 30 | 14:55 | 20 | 12 | 20 | 0.01544 | 14.3 | 0.0066 | 5.35 | 25.8 |
| 60 | 15:15 | 15 | 11 | 20 | 0.01544 | 14.5 | 0.0057 | 4.78 | 21.8 |
| 240 | 18:20 | 4 | 0 | 20 | 0.01544 | 15.0 | 0.0033 | 1.64 | 14.8 |
| 1440 | 18:53 | 13 | 0 | 20 | 0.01544 | 15.6 | 0.0014 | 0.9 | 9.3 |

| GRADATION: | | HYDROMETER ANALYSIS | | MATERIAL CLASSIFICATION | | |
|-----------------|-------|---------------------|-------------|--|---------------|---------|
| ASTM Sieve Size | MM | Smaller than | Passing (%) | Type | Spec (Metric) | Percent |
| 2" | 50.0 | 100.0 | 100.0 | Gravel | >4.75 | 0.0 |
| 1 1/2" | 37.5 | 100.0 | 100.0 | Coarse Sand | 2mm-4.75mm | 7.6 |
| 1" | 25.0 | 100.0 | 100.0 | Fine Sand | 425-75um | 21.8 |
| 3/4" | 19.0 | 100.0 | 100.0 | Silt | 75-2um | 68.2 |
| 2" | 12.5 | 100.0 | 100.0 | Clay | <2um | 12.5 |
| 3/8" | 9.5 | 100.0 | 100.0 | Total Percent Silt & Clay (% Passing 75micron sieve) | | 70.7 |
| 1/4" | 6.3 | 100.0 | 100.0 | Coarser than | | 0.0 |
| #4 | 4.75 | 100.0 | 100.0 | | | |
| #10 | 1.5 | 100.0 | 100.0 | | | |
| #16 | 1.18 | 98.9 | 98.9 | | | |
| #30 | 0.60 | 35.6 | 35.6 | | | |
| #40 | 0.425 | 31.4 | 31.4 | | | |
| #50 | 0.30 | 25.8 | 25.8 | | | |
| #100 | 0.15 | 9.3 | 9.3 | | | |
| #200 | 0.075 | 7.7 | 7.7 | | | |

GRAIN SIZE ACCUMULATION CURVE

| | | |
|-----------------------------------|---|--|
| TESTED BY (signature): <i>Rob</i> | COMPUTED BY (signature): <i>[Signature]</i> | CHECKED BY (signature): <i>[Signature]</i> |
|-----------------------------------|---|--|

A7 - 3



P.O. Box 130, Camero River Road, Dili, East Timor
 Tel. 001 670 3 313813, Fax. 0011 6703 312407
 Email: info@rmsende.com.au
 Web Site: www.rmsende.com.au

MATERIALS TESTING CENTRE

| GRAIN - SIZE ANALYSIS (HYDROMETER METHOD) REPORT | | | | | | | | | |
|--|------------------------|-------------------------------|---------------------------------------|-----------|---|---------------------------------------|---------------------------|---------------|-----------|
| PROJECT: VEMASSE RIVER | | | LOCATION: Vemasse | | | DATE: 09-Dec-12 | | | |
| COORDINATES: (20-30cm) Middle Down No.04 | | | SAMPLE SPECIMEN: Soil (20-30cm) No.04 | | | CLASSIFICATION: | | | |
| DISH NUMBER: 02 | | | CYLINDER ID: C11 | | | HYDROMETER TYPE (151H/152H): 152H | | | |
| DISPERSING AGENT USED: sodium hexametaphosphate | | | QUANTITY: 125mL at 40g/L solution | | | COMPOSITE CORRECTION: See calibration | | | |
| DECIMAL FINES: 1 (00) | | | 8% GR. OF SOLIDS, 80 = 2.47 | | | | | | |
| Time (Minutes) | ELAPSED TIME (Minutes) | ACTUAL HYDROMETER READING (R) | CORRECTED READING (R) | TEMP (°C) | TEMPERATURE AND SPECIFIC GRAVITY CONSTANT (K) | EFFECTIVE DEPTH (L) | PARTICLE DIAMETER (D), mm | PERCENT FINER | |
| | | | | | | | | (A) Partial | (B) Total |
| Start | 9:57 | - | - | - | - | - | - | - | - |
| 1 | 9:46 | 35 | 27 | 20 | 0.0149 | 11.9 | 0.049 | 55.5 | 58.2 |
| 2 | 9:50 | 33 | 25 | 20 | 0.0149 | 12.2 | 0.0353 | 6.2 | 52.0 |
| 3 | 10:02 | 31 | 23 | 20 | 0.0149 | 12.5 | 0.0225 | 47.24 | 47.6 |
| 15 | 10:12 | 30 | 22 | 20 | 0.0149 | 12.7 | 0.0122 | 45.78 | 45.8 |
| 30 | 10:27 | 28 | 21 | 20 | 0.0149 | 12.8 | 0.0094 | 43.88 | 43.7 |
| 60 | 10:57 | 27 | 18 | 20 | 0.0149 | 13.2 | 0.0067 | 39.52 | 39.6 |
| 60 | 11:17 | 25 | 17 | 20 | 0.0149 | 13.5 | 0.0059 | 35.58 | 35.4 |
| 240 | 14:14 | 22 | 14 | 20 | 0.0149 | 14.0 | 0.0034 | 29.12 | 29.1 |
| 1440 | 9:57 | 20 | 12 | 20 | 0.0149 | 14.3 | 0.0014 | 24.06 | 25.0 |

| GRADATION: | | HYDROMETER ANALYSIS | | MATERIAL CLASSIFICATION | | |
|-----------------|-------|---------------------|-------------|--|---------------|---------|
| ASTM Sieve Size | MM | Smaller than | Passing (%) | Type | Spec (Metric) | Percent |
| 2" | 50.0 | 100.0 | 100.0 | Gravel | >4.75 | 0.0 |
| 1 1/2" | 37.5 | 100.0 | 100.0 | Coarse Sand | 2mm-4.75mm | 2.9 |
| 1" | 25.0 | 100.0 | 100.0 | Fine Sand | 425-75um | 21.1 |
| 3/4" | 19.0 | 100.0 | 100.0 | Silt | 75-2um | 68.6 |
| 2" | 12.5 | 100.0 | 100.0 | Clay | <2um | 26.5 |
| 3/8" | 9.5 | 100.0 | 100.0 | Total Percent Silt & Clay (% Passing 75micron sieve) | | 95.0 |
| 1/4" | 6.3 | 100.0 | 100.0 | Coarser than | | 0.0 |
| #4 | 4.75 | 100.0 | 100.0 | | | |
| #10 | 1.5 | 100.0 | 100.0 | | | |
| #16 | 1.18 | 98.9 | 98.9 | | | |
| #30 | 0.60 | 35.6 | 35.6 | | | |
| #40 | 0.425 | 31.4 | 31.4 | | | |
| #50 | 0.30 | 25.8 | 25.8 | | | |
| #100 | 0.15 | 9.3 | 9.3 | | | |
| #200 | 0.075 | 7.7 | 7.7 | | | |

GRAIN SIZE ACCUMULATION CURVE

| | | |
|-----------------------------------|---|--|
| TESTED BY (signature): <i>Rob</i> | COMPUTED BY (signature): <i>[Signature]</i> | CHECKED BY (signature): <i>[Signature]</i> |
|-----------------------------------|---|--|



P.O. Box 136, Comoro River Road, Dili, East Timor
 Tel. 001 670 3 313813, Fax. 0011 6703 312407
 Email: hpc@rmsandc.com.au
 Web Site: www.rmsandc.com.au

MATERIALS TESTING CENTRE

| GRAIN - SIZE ANALYSIS (HYDROMETER METHOD) REPORT | | | | | | | | | |
|--|------------------------|-------------------------------|--|-----------|---|---|--------------------------|---------------|-----------|
| PROJECT: Vemasse River | | | LOCATION: Vemasse | | | DATE: 11-Dec-12 | | | |
| COORDINATES: 20 30cm Middle Upper No.03 | | | SAMPLE/SPECIMEN: Soil (20-30cm) NUMBER: Middle Upper No.03 | | | CLASSIFICATION: | | | |
| DISH NUMBER: 03 | | | CYLINDER ID.: C9 | | | HYDROMETER TYPE (151H/152H): 152H | | | |
| DISPERSING AGENT USED: sodium hexametaphosphate | | | | | QUANTITY: 125ml at 40g/L solution | | | | |
| COMPOSITE CORRECTION: see calibration | | | DECIMAL FINES: 1.000 | | | SP.GR. OF SOLIDS, G _s = 2.62 | | | |
| Time (Minutes) | ELAPSED TIME (Minutes) | ACTUAL HYDROMETER READING (R) | CORRECTED READING (R) | TEMP (°C) | TEMPERATURE AND SPECIFIC GRAVITY CONSTANT (K) | EFFECTIVE DEPTH (L) | PARTICLE DIAMETER (D),mm | PERCENT FINER | |
| | | | | | | | | (A) Partial | (B) Total |
| Start | 0:30 | - | - | - | - | - | - | - | - |
| 1 | 0:39 | 42 | 34 | 20 | 0.01385 | 10.7 | 0.545 | 66.6E | 68.7 |
| 5 | 0:43 | 39 | 31 | 20 | 0.01385 | 11.2 | 0.0318 | 62.6E | 67.6 |
| 15 | 0:43 | 37 | 29 | 20 | 0.01385 | 11.4 | 0.0219 | 60.6E | 66.6 |
| 30 | 10:06 | 36 | 28 | 20 | 0.01385 | 11.5 | 0.0122 | 58.5E | 63.6E |
| 60 | 10:56 | 34 | 26 | 20 | 0.01385 | 11.7 | 0.0057 | 56.5E | 58.6E |
| 90 | 10:56 | 34 | 26 | 20 | 0.01385 | 12.0 | 0.0032 | 52.6E | 52.6E |
| 120 | 10:56 | 32 | 24 | 20 | 0.01385 | 12.4 | 0.0054 | 48.4E | 48.5E |
| 150 | 10:56 | 29 | 21 | 20 | 0.01385 | 12.8 | 0.0031 | 42.4E | 42.4E |
| 180 | 0:38 | 28 | 17 | 20 | 0.01385 | 13.5 | 0.0015 | 34.3E | 34.3E |

| GRADATION: | |
|------------|--------------|
| SIEVE SIZE | % on Passing |
| 2" | 100.0 |
| 1 1/2" | 100.0 |
| 3/4" | 100.0 |
| 3/8" | 100.0 |
| 1/2" | 100.0 |
| 3/8" | 100.0 |
| 1/4" | 100.0 |
| #4 | 100.0 |
| #10 | 100.0 |
| #16 | 99.9 |
| #30 | 99.7 |
| #60 | 99.4 |
| #80 | 98.3 |
| #100 | 96.7 |
| #200 | 94.7 |

| HYDROMETER ANALYSIS | |
|---------------------|---------|
| Smaller than | Passing |
| 0.075mm | 66 |
| 0.002mm | 34 |
| 0.001mm | 0 |

| MATERIAL CLASSIFICATION | | |
|---|---------------|---------|
| Type | Size (mm) | Percent |
| Gravel | >2mm | 0.0 |
| Coarse Sand | 0.6mm-2.0mm | 0.0 |
| Fine Sand | 0.075-0.6mm | 4.7 |
| Silt | 0.002-0.075mm | 56.7 |
| Clay | <0.002mm | 38.0 |
| Total Percent Silt & Clay (%) (Passing 75 micron sieve) | | |
| 94.7 | | |
| Coarsest <1mm | | |
| 0.3 | | |

TESTED BY (signature): *John* COMPUTED BY (signature): *[Signature]* CHECKED BY (Signature): *[Signature]*



P.O. Box 136, Comoro River Road, Dili, East Timor
 Tel. 001 670 3 313813, Fax. 0011 6703 312407
 Email: hpc@rmsandc.com.au
 Web Site: www.rmsandc.com.au

MATERIALS TESTING CENTRE

| GRAIN - SIZE ANALYSIS (HYDROMETER METHOD) REPORT | | | | | | | | | |
|--|------------------------|-------------------------------|--|-----------|---|---|--------------------------|---------------|-----------|
| PROJECT: Vemasse River | | | LOCATION: Vemasse | | | DATE: 10-Dec-12 | | | |
| COORDINATES: West Upper (50-70cm) | | | SAMPLE/SPECIMEN: Soil West Upper NUMBER: (6C-7Ccm) | | | CLASSIFICATION: | | | |
| DISH NUMBER: 04 | | | CYLINDER ID.: C13 | | | HYDROMETER TYPE (151H/152H): 152H | | | |
| DISPERSING AGENT USED: sodium hexametaphosphate | | | | | QUANTITY: 125ml at 40g/L solution | | | | |
| COMPOSITE CORRECTION: see calibration | | | DECIMAL FINES: 1.000 | | | SP.GR. OF SOLIDS, G _s = 2.70 | | | |
| Time (Minutes) | ELAPSED TIME (Minutes) | ACTUAL HYDROMETER READING (R) | CORRECTED READING (R) | TEMP (°C) | TEMPERATURE AND SPECIFIC GRAVITY CONSTANT (K) | EFFECTIVE DEPTH (L) | PARTICLE DIAMETER (D),mm | PERCENT FINER | |
| | | | | | | | | (A) Partial | (B) Total |
| Start | 1:10 | - | - | - | - | - | - | - | - |
| 1 | 1:11 | 45 | 37 | 20 | 0.01385 | 10.2 | 0.044 | 73.2E | 73.3 |
| 5 | 1:12 | 42 | 34 | 20 | 0.01385 | 10.7 | 0.0316 | 67.3E | 67.3 |
| 15 | 1:12 | 39 | 31 | 20 | 0.01385 | 11.2 | 0.0204 | 61.3E | 61.4 |
| 30 | 10:58 | 37 | 29 | 20 | 0.01385 | 11.4 | 0.0126 | 43.6E | 43.6 |
| 60 | 10:58 | 36 | 28 | 20 | 0.01385 | 11.5 | 0.0051 | 35.8E | 35.6 |
| 90 | 11:00 | 34 | 26 | 20 | 0.01385 | 11.7 | 0.0066 | 28.7E | 28.7 |
| 120 | 11:00 | 32 | 24 | 20 | 0.01385 | 12.0 | 0.0067 | 27.2E | 27.7 |
| 150 | 14:37 | 29 | 21 | 20 | 0.01385 | 12.4 | 0.0053 | 17.6E | 17.6 |
| 180 | 16:20 | 28 | 17 | 20 | 0.01385 | 13.1 | 0.0014 | 13.6E | 13.8 |

| GRADATION: | |
|------------|-----------------|
| SIEVE SIZE | Percent Passing |
| 2" | 100.0 |
| 1 1/2" | 100.0 |
| 3/4" | 100.0 |
| 3/8" | 100.0 |
| 1/2" | 100.0 |
| 3/8" | 100.0 |
| 1/4" | 100.0 |
| #4 | 100.0 |
| #10 | 100.0 |
| #16 | 99.9 |
| #30 | 99.7 |
| #60 | 99.4 |
| #80 | 98.3 |
| #100 | 96.7 |
| #200 | 94.7 |

| HYDROMETER ANALYSIS | |
|---------------------|---------|
| Smaller than | Passing |
| 0.075mm | 54.3 |
| 0.002mm | 15.3 |
| 0.001mm | 0 |

| MATERIAL CLASSIFICATION | | |
|---|---------------|---------|
| Type | Size (mm) | Percent |
| Gravel | >2mm | 0.0 |
| Coarse Sand | 0.6mm-2.0mm | 0.8 |
| Fine Sand | 0.075-0.6mm | 5.6 |
| Silt | 0.002-0.075mm | 78.4 |
| Clay | <0.002mm | 15.3 |
| Total Percent Silt & Clay (%) (Passing 75 micron sieve) | | |
| 93.7 | | |
| Coarsest <1mm | | |
| 0.6 | | |

TESTED BY (signature): *John* COMPUTED BY (signature): *[Signature]* CHECKED BY (Signature): *[Signature]*



P.O. Box 130, Comoro River Road, Dili, East Timor
Tel. 001 670 3 313813, Fax. 0011 6703 312407
Email: topcon@amscaul.com.au
Web Site: www.amscaul.com.au

MATERIALS TESTING CENTRE

| GRAIN - SIZE ANALYSIS (HYDROMETER METHOD) REPORT | | | | | | | | | | | |
|--|------------------------|---------------------------------|--|-----------|---|--|------------------------|---------------|-----------|--|--|
| PROJECT: Vemasse River | | | LOCATION: Vemasse | | | DATE: 18-Dec-12 | | | | | |
| COORDINATES: (70-80cm) East down No. 1 | | | SAMPLE/SPECIMEN Soil (70-80cm) NUMBER: East down No. 1 | | | CLASSIFICATION: | | | | | |
| DISH NUMBER: D5 | | | CYLINDER ID.: C10 | | | HYDROMETER TYPE (151H/152H): 152H | | | | | |
| DISPERSING AGENT USED: sodium hexametaphosphate | | | | | | QUANTITY: 125ml. at 4% solution | | | | | |
| COMPOSITE CORRECTION: Size calibration | | | DECIMAL FINES: 1.000 | | | SP. GR. OF SOLIDS, G _s : 2.34 | | | | | |
| Time (Minutes) | ELAPSED TIME (Minutes) | ACTUAL HYDROMETER READING (g/l) | CORRECTED READING (g) | TEMP (°C) | TEMPERATURE AND SPECIFIC GRAVITY CONSTANT (K) | EFFECTIVE DEPTH (L) | PARTICLE DIAMETER (µm) | PERCENT FINER | | | |
| | | | | | | | | (A) Partial | (B) Total | | |
| Start | 9:40 | | | | | | | | | | |
| 1 | 9:41 | 9 | 11 | 20 | 0.01386 | 14.5 | 0.0526 | 22.22 | 22.2 | | |
| 2 | 9:42 | 9 | 11 | 20 | 0.01386 | 14.8 | 0.0377 | 18.18 | 18.2 | | |
| 5 | 9:45 | 9 | 11 | 20 | 0.01386 | 15 | 0.0241 | 14.14 | 14.1 | | |
| 15 | 9:45 | 9 | 11 | 20 | 0.01386 | 15.3 | 0.0140 | 12.12 | 12.1 | | |
| 30 | 9:49 | 9 | 11 | 20 | 0.01386 | 15.5 | 0.0100 | 10.1 | 10.1 | | |
| 60 | 10:40 | 12 | 4 | 20 | 0.01386 | 15.6 | 0.0071 | 6.08 | 6.1 | | |
| 80 | 11:29 | 11 | 3 | 20 | 0.01386 | 15.8 | 0.0062 | 5.06 | 5.1 | | |
| 250 | 3:53 | 10 | 2 | 20 | 0.01386 | 16.0 | 0.0055 | 4.04 | 4.0 | | |
| 1440 | 3:40 | 0 | 1 | 20 | 0.01386 | 16.1 | 0.0015 | 2.02 | 2.0 | | |

| GRAZATION | | HYDROMETER ANALYSIS | | MATERIAL CLASSIFICATION | | |
|-----------|-------|---------------------|---------|-------------------------|-----------|---------|
| ASTM | MM | Retain | Passing | Type | Size (µm) | Percent |
| 2" | 50.8 | 0 | 100.0 | Gravel | >2mm | 0.0 |
| 1 1/2" | 37.5 | 0 | 100.0 | | | |
| 1" | 25.0 | 0 | 100.0 | | | |
| 3/4" | 19.0 | 0 | 100.0 | | | |
| 1/2" | 12.5 | 0 | 100.0 | | | |
| 3/8" | 9.5 | 0 | 100.0 | | | |
| 1/4" | 6.3 | 0 | 100.0 | | | |
| #4 | 4.75 | 0 | 100.0 | | | |
| #10 | 2.0 | 0 | 100.0 | | | |
| #20 | 0.85 | 0 | 100.0 | | | |
| #40 | 0.425 | 0 | 100.0 | | | |
| #60 | 0.25 | 0 | 100.0 | | | |
| #100 | 0.15 | 0 | 100.0 | | | |
| #200 | 0.075 | 0 | 100.0 | | | |

| HYDROMETER ANALYSIS | | MATERIAL CLASSIFICATION | |
|---|---------|-------------------------|--------------|
| Size (mm) | Percent | Type | Size (µm) |
| 0.075mm | 0 | Coarse Sand | 0.075-0.25mm |
| 0.075mm | 0 | Fine Sand | 0.075-0.25mm |
| 0.075mm | 0 | Silt | 0.25-75µm |
| 0.075mm | 0 | Clay | >2µm |
| Total Percent Silt & Clay (4% Retaining 75µm sieve) | | 33.0 | |
| Coarse < 0.075mm | | 0.0 | |

TESTED BY (Signature): *[Signature]* COMPUTED BY (Signature): *[Signature]* CHECKED BY (Signature): *[Signature]*

A7 - 5



P.O. Box 130, Comoro River Road, Dili, East Timor
Tel. 001 670 3 313813, Fax. 0011 6703 312407
Email: topcon@amscaul.com.au
Web Site: www.amscaul.com.au

MATERIALS TESTING CENTRE

| GRAIN - SIZE ANALYSIS (HYDROMETER METHOD) REPORT | | | | | | | | | | | |
|--|------------------------|---------------------------------|---|-----------|---|--|------------------------|---------------|-----------|--|--|
| PROJECT: Vemasse River | | | LOCATION: Vemasse | | | DATE: 11-Dec-12 | | | | | |
| COORDINATES: (70-80cm) Middle Upper No. 03 | | | SAMPLE/SPECIMEN Soil (70-80cm) NUMBER: Middle Upper No. | | | CLASSIFICATION: | | | | | |
| DISH NUMBER: D6 | | | CYLINDER ID.: C6 | | | HYDROMETER TYPE (151H/152H): 152H | | | | | |
| DISPERSING AGENT USED: sodium hexametaphosphate | | | | | | QUANTITY: 125ml. at 4% solution | | | | | |
| COMPOSITE CORRECTION: Size calibration | | | DECIMAL FINES: 1.000 | | | SP. GR. OF SOLIDS, G _s : 2.37 | | | | | |
| Time (Minutes) | ELAPSED TIME (Minutes) | ACTUAL HYDROMETER READING (g/l) | CORRECTED READING (g) | TEMP (°C) | TEMPERATURE AND SPECIFIC GRAVITY CONSTANT (K) | EFFECTIVE DEPTH (L) | PARTICLE DIAMETER (µm) | PERCENT FINER | | | |
| | | | | | | | | (A) Partial | (B) Total | | |
| Start | 14:20 | | | | | | | | | | |
| 1 | 14:21 | 43 | 35 | 20 | 0.01386 | 0.6 | 0.045 | 70.70 | 70.7 | | |
| 2 | 14:22 | 41 | 33 | 20 | 0.01386 | 0.6 | 0.0325 | 65.96 | 66.7 | | |
| 5 | 14:25 | 39 | 31 | 20 | 0.01386 | 0.6 | 0.0206 | 62.52 | 62.6 | | |
| 15 | 14:25 | 25 | 20 | 20 | 0.01386 | 1.4 | 0.0121 | 60.80 | 60.8 | | |
| 30 | 14:50 | 27 | 24 | 20 | 0.01386 | 1.5 | 0.0066 | 58.58 | 58.6 | | |
| 60 | 15:20 | 35 | 27 | 20 | 0.01386 | 1.5 | 0.0062 | 54.54 | 54.5 | | |
| 80 | 15:40 | 33 | 25 | 20 | 0.01386 | 1.2 | 0.0054 | 50.50 | 50.5 | | |
| 250 | 18:27 | 25 | 20 | 20 | 0.01386 | 13.0 | 0.0032 | 40.40 | 40.4 | | |
| 1440 | 14:20 | 24 | 18 | 20 | 0.01386 | 13.0 | 0.0014 | 32.32 | 32.3 | | |

| GRAZATION | | HYDROMETER ANALYSIS | | MATERIAL CLASSIFICATION | | |
|-----------|-------|---------------------|---------|-------------------------|-----------|---------|
| ASTM | MM | Retain | Passing | Type | Size (µm) | Percent |
| 2" | 50.8 | 0 | 100.0 | Gravel | >2mm | 0.0 |
| 1 1/2" | 37.5 | 0 | 100.0 | | | |
| 1" | 25.0 | 0 | 100.0 | | | |
| 3/4" | 19.0 | 0 | 100.0 | | | |
| 1/2" | 12.5 | 0 | 100.0 | | | |
| 3/8" | 9.5 | 0 | 100.0 | | | |
| 1/4" | 6.3 | 0 | 100.0 | | | |
| #4 | 4.75 | 0 | 100.0 | | | |
| #10 | 2.0 | 0 | 100.0 | | | |
| #20 | 0.85 | 0 | 100.0 | | | |
| #40 | 0.425 | 0 | 100.0 | | | |
| #60 | 0.25 | 0 | 100.0 | | | |
| #100 | 0.15 | 0 | 100.0 | | | |
| #200 | 0.075 | 0 | 100.0 | | | |

| HYDROMETER ANALYSIS | | MATERIAL CLASSIFICATION | |
|---|---------|-------------------------|--------------|
| Size (mm) | Percent | Type | Size (µm) |
| 0.075mm | 0.1 | Coarse Sand | 0.075-0.25mm |
| 0.075mm | 0.1 | Fine Sand | 0.075-0.25mm |
| 0.075mm | 0.1 | Silt | 0.25-75µm |
| 0.075mm | 0.1 | Clay | >2µm |
| Total Percent Silt & Clay (4% Retaining 75µm sieve) | | 83.3 | |
| Coarse < 0.075mm | | 0.1 | |

TESTED BY (Signature): *[Signature]* COMPUTED BY (Signature): *[Signature]* CHECKED BY (Signature): *[Signature]*



P.O. Box 130, Comoro River Road, Dili, East Timor
 Tel. 001 670 3 313813, Fax. 0011 6703 312407
 Email: testing@rmsaustralia.com.au
 Web Site: www.rmsaustralia.com.au

MATERIALS TESTING CENTRE

| GRAIN - SIZE ANALYSIS (HYDROMETER METHOD) REPORT | | | | | | | | | |
|---|------------------------|-------------------------------|---|-----------|---|---|-------------------------|---------------|-----------|
| PROJECT : Vemasse River | | | LOCATION : Vemasse | | | DATE : 11-Dec-11 | | | |
| COORDINATES : (80 cm, Middle Down No.4) | | | SAMPLE/SPECIMEN No. / (80 cm) Middle NUMBER - D2m No.4 | | | CLASSIFICATION : | | | |
| DISH NUMBER : D7 | | | CYLINDER ID. : C3 | | | HYDROMETER TYPE (151H/152H): 152H | | | |
| DISPERSING AGENT USED : sodium hexametaphosphate | | | | | | QUANTITY : 125mL at 4.5g/L solution | | | |
| COMPOSITE CORRECTION : See calibration | | | DECIMAL FINES : 1.003 | | | SP GR. OF SOLIDS, G/L : 2.51 | | | |
| Time (Minutes) | ELAPSED TIME (Minutes) | ACTUAL HYDROMETER READING (R) | CORRECTED READING (R) | TEMP (°C) | TEMPERATURE AND SPECIFIC GRAVITY CONSTANT (K) | EFFECTIVE DEPTH (L) | PARTICLE DIAMETER (D)mm | PERCENT FINER | |
| | | | | | | | | (A) Partic | (B) Total |
| Start | 0:00 | - | - | - | - | - | - | - | - |
| 1 | 1:29 | 49 | 43 | 20 | 0.01431 | 0.7 | 0.545 | 82.4 | 82.4 |
| 2 | 1:30 | 49 | 37 | 20 | 0.01431 | 0.6 | 0.8324 | 76.22 | 76.2 |
| 5 | 1:33 | 41 | 33 | 20 | 0.01431 | 1.0 | 0.8211 | 67.98 | 68.0 |
| 15 | 1:43 | 35 | 31 | 20 | 0.01431 | 1.12 | 0.8124 | 63.86 | 63.9 |
| 30 | 1:48 | 39 | 28 | 20 | 0.01431 | 1.17 | 0.8089 | 57.65 | 57.7 |
| 50 | 1:49 | 35 | 27 | 20 | 0.01431 | 1.19 | 0.8064 | 55.62 | 55.6 |
| 80 | 1:49 | 34 | 26 | 20 | 0.01431 | 1.20 | 0.805 | 53.56 | 53.6 |
| 250 | 1:48 | 30 | 22 | 20 | 0.01431 | 1.27 | 0.8032 | 45.32 | 45.3 |
| 1540 | 1:48 | 25 | 17 | 20 | 0.01431 | 13.5 | 0.8214 | 35.02 | 35.0 |

| GRADATION: | | HYDROMETER ANALYSIS | | MAXIMUM CLASSIFICATION | | |
|------------|-------|---------------------|---------|------------------------|---------------|---------|
| ASTM | UM | Smaller than | Passing | Type | Size (mm) | Percent |
| 2 | 53.00 | 100.0 | | Gravel | 75mm | 0.0 |
| 1-1/2" | 37.50 | 100.0 | | Coarse Sand | 4.75mm-4.25mm | 1.4 |
| 1" | 25.00 | 100.0 | | Fine Sand | 4.25-0.75mm | 7.7 |
| 3/4" | 19.00 | 100.0 | | Silt | 75-2µm | 51.4 |
| 1/2" | 12.50 | 100.0 | | Clay | <2µm | 39.5 |
| 3/8" | 9.50 | 100.0 | | | | |
| 1/4" | 6.25 | 100.0 | | | | |
| #20 | 0.75 | 100.0 | | | | |
| #30 | 0.600 | 99.9 | | | | |
| #40 | 0.425 | 96.5 | | | | |
| #50 | 0.300 | 96.2 | | | | |
| #100 | 0.150 | 94.6 | | | | |
| #200 | 0.075 | 90.9 | | | | |

| HYDROMETER ANALYSIS | | MAXIMUM CLASSIFICATION | | | |
|---------------------|---------|-------------------------------|---------------|---------|--|
| Smaller than | Passing | Type | Size (mm) | Percent | |
| 0.075mm | 90.9 | Gravel | 75mm | 0.0 | |
| 0.002mm | 39.5 | Coarse Sand | 4.75mm-4.25mm | 1.4 | |
| 0.001mm | 0 | Fine Sand | 4.25-0.75mm | 7.7 | |
| | | Silt | 75-2µm | 51.4 | |
| | | Clay | <2µm | 39.5 | |
| | | Total Percent Silt & Clay (%) | | 90.9 | |
| | | Passing 75micron sieve | | | |
| | | Colloids <1µm | | 0.0 | |

GRAIN SIZE ACCUMULATION CURVE

| | | |
|-----------------------|-------------------------|------------------------|
| TESTED BY (signature) | COMPUTED BY (signature) | CHECKED BY (signature) |
|-----------------------|-------------------------|------------------------|

A7 - 6



P.O. Box 130, Comoro River Road, Dili, East Timor
 Tel. 001 670 3 313813, Fax. 0011 6703 312407
 Email: testing@rmsaustralia.com.au
 Web Site: www.rmsaustralia.com.au

MATERIALS TESTING CENTRE

| GRAIN - SIZE ANALYSIS (HYDROMETER METHOD) REPORT | | | | | | | | | |
|---|------------------------|-------------------------------|---|-----------|---|---|-------------------------|---------------|-----------|
| PROJECT : Vemasse River | | | LOCATION : Vemasse | | | DATE : 18-Dec-12 | | | |
| COORDINATES : (V.E.L.P 30cm) No. 01 | | | SAMPLE/SPECIMEN No. / (V.E.L.P 30cm) No. 01 | | | CLASSIFICATION : | | | |
| DISH NUMBER : D8 | | | CYLINDER ID. : C16 | | | HYDROMETER TYPE (151H/152H): 152H | | | |
| DISPERSING AGENT USED : sodium hexametaphosphate | | | | | | QUANTITY : 125mL at 4.5g/L solution | | | |
| COMPOSITE CORRECTION : See calibration | | | DECIMAL FINES : 1.300 | | | SP GR. OF SOLIDS, G/L : 2.54 | | | |
| Time (Minutes) | ELAPSED TIME (Minutes) | ACTUAL HYDROMETER READING (R) | CORRECTED READING (R) | TEMP (°C) | TEMPERATURE AND SPECIFIC GRAVITY CONSTANT (K) | EFFECTIVE DEPTH (L) | PARTICLE DIAMETER (D)mm | PERCENT FINER | |
| | | | | | | | | (A) Partic | (B) Total |
| Start | 0:04 | - | - | - | - | - | - | - | - |
| 1 | 0:05 | 49 | 43 | 20 | 0.01431 | 0.7 | 0.545 | 80.80 | 80.8 |
| 2 | 0:06 | 45 | 37 | 20 | 0.01431 | 0.6 | 0.8311 | 78.79 | 78.8 |
| 5 | 0:09 | 43 | 35 | 20 | 0.01431 | 0.6 | 0.8201 | 73.70 | 73.7 |
| 15 | 0:10 | 41 | 32 | 20 | 0.01431 | 0.6 | 0.8115 | 64.64 | 64.6 |
| 30 | 0:14 | 39 | 31 | 20 | 0.01431 | 0.6 | 0.8085 | 62.62 | 62.6 |
| 50 | 0:14 | 36 | 29 | 20 | 0.01431 | 0.6 | 0.8051 | 56.55 | 56.6 |
| 80 | 0:14 | 33 | 26 | 20 | 0.01431 | 0.6 | 0.8024 | 52.60 | 52.6 |
| 250 | 0:14 | 28 | 17 | 20 | 0.01431 | 13.5 | 0.8032 | 34.34 | 34.3 |
| 1440 | 0:14 | 17 | 9 | 20 | 0.01431 | 14.8 | 0.8014 | 13.10 | 13.2 |

| GRADATION: | | HYDROMETER ANALYSIS | | MAXIMUM CLASSIFICATION | | |
|------------|-------|---------------------|---------|------------------------|---------------|---------|
| ASTM | UM | Smaller than | Passing | Type | Size (mm) | Percent |
| 2 | 53.00 | 100.0 | | Gravel | 75mm | 0.0 |
| 1-1/2" | 37.50 | 100.0 | | Coarse Sand | 4.75mm-4.25mm | 1.4 |
| 1" | 25.00 | 100.0 | | Fine Sand | 4.25-0.75mm | 7.7 |
| 3/4" | 19.00 | 100.0 | | Silt | 75-2µm | 51.4 |
| 1/2" | 12.50 | 100.0 | | Clay | <2µm | 39.5 |
| 3/8" | 9.50 | 100.0 | | | | |
| 1/4" | 6.25 | 100.0 | | | | |
| #20 | 0.75 | 100.0 | | | | |
| #30 | 0.600 | 99.9 | | | | |
| #40 | 0.425 | 97.3 | | | | |
| #50 | 0.300 | 96.9 | | | | |
| #100 | 0.150 | 95.2 | | | | |
| #200 | 0.075 | 94.4 | | | | |

| HYDROMETER ANALYSIS | | MAXIMUM CLASSIFICATION | | | |
|---------------------|---------|-------------------------------|---------------|---------|--|
| Smaller than | Passing | Type | Size (mm) | Percent | |
| 0.075mm | 94.4 | Gravel | 75mm | 0.0 | |
| 0.002mm | 26 | Coarse Sand | 4.75mm-4.25mm | 3.1 | |
| 0.001mm | 0 | Fine Sand | 4.25-0.75mm | 2.5 | |
| | | Silt | 75-2µm | 65.4 | |
| | | Clay | <2µm | 26.0 | |
| | | Total Percent Silt & Clay (%) | | 91.4 | |
| | | Passing 75micron sieve | | | |
| | | Colloids <1µm | | 0.0 | |

GRAIN SIZE ACCUMULATION CURVE

| | | |
|-----------------------|-------------------------|------------------------|
| TESTED BY (signature) | COMPUTED BY (signature) | CHECKED BY (signature) |
|-----------------------|-------------------------|------------------------|



P.O. Box 130, Comoro River Road, Dili, East Timor
 Tel. 001 670 3 313813, Fax. 0011 6703 312407
 Email: foynes@mtscade.com.au
 Web Site: www.mtsacade.com.au

MATERIALS TESTING CENTRE

| GRAIN - SIZE ANALYSIS (HYDROMETER METHOD) REPORT | | | | | | | | | |
|---|------------------------|--------------------------------|--|-----------|---|--|--------------------------|---------------|-----------|
| PROJECT : Vemasse River | | | LOCATION : Vemasse | | | DATE : 18-Dec-12 | | | |
| COORDINATES : (30cm) V.E UP No C2 | | | SAMPLE/SPECIMEN Soil (30cm) V.E UP NUMBER : No.02 | | | CLASSIFICATION : | | | |
| DISH NUMBER : D9 | | | CYLINDER ID. : C22 | | | HYDROMETER TYPE (151)H/152H : 152H | | | |
| DISPERSING AGENT USED : sodium hexametaphosphate | | | | | | QUANTITY : 125mL at 40g/L solution | | | |
| COMPOSITE CORRECTION : See calibration | | | DECIMAL FINES : 1.001 | | | SP. GR. OF SOLIDS, G/G* 2.64 | | | |
| Time (Minutes) | ELAPSED TIME (Minutes) | ACTUAL HYDROMETER READING (R1) | CORRECTED READING (R) | TEMP (°C) | TEMPERATURE AND SPECIFIC GRAVITY CONSTANT (K) | EFFECTIVE DEPTH (L) | PARTICLE DIAMETER (D),mm | PERCENT FINER | |
| | | | | | | | | (A) Partial | (B) Total |
| Start | 0:00 | - | - | - | - | - | - | - | - |
| 1 | 0:04 | 38 | 30 | 20 | 0.01107 | 11.4 | 0.044 | 58.2 | 58.2 |
| 2 | 0:08 | 36 | 28 | 20 | 0.01107 | 11.7 | 0.0316 | 54.32 | 54.3 |
| 5 | 0:15 | 26 | 21 | 20 | 0.01107 | 12.8 | 0.0210 | 40.74 | 40.7 |
| 15 | 0:35 | 25 | 17 | 20 | 0.01107 | 13.6 | 0.0124 | 32.98 | 33.0 |
| 30 | 0:50 | 24 | 15 | 20 | 0.01107 | 13.7 | 0.0086 | 31.04 | 31.0 |
| 60 | 1:10 | 23 | 15 | 20 | 0.01107 | 13.8 | 0.0065 | 26.1 | 26.1 |
| 90 | 1:16 | 22 | 14 | 20 | 0.01107 | 14.0 | 0.0055 | 27.16 | 27.2 |
| 240 | 1:45 | 18 | 11 | 20 | 0.01107 | 14.5 | 0.0031 | 21.34 | 21.3 |
| 1440 | 9:50 | 14 | 6 | 20 | 0.01107 | 15.3 | 0.0013 | 11.64 | 11.6 |

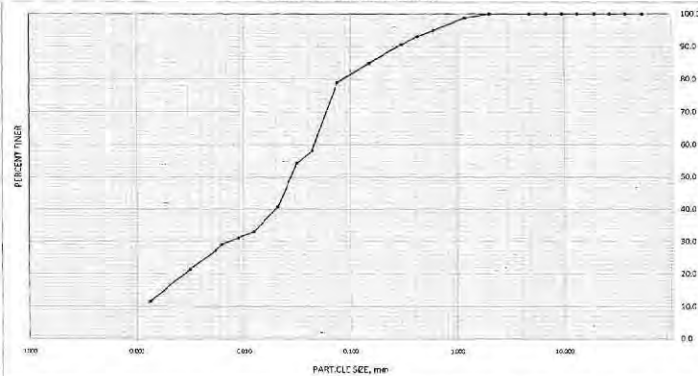
GRADATION:

| SIEVE SIZE | MM | Percent Passing |
|------------|-------|-----------------|
| ASTM #2 | 75.00 | 100.0 |
| -1/2" | 37.50 | 100.0 |
| #1 | 25.00 | 100.0 |
| 3/4" | 19.00 | 100.0 |
| #10 | 1.90 | 100.0 |
| #20 | 0.85 | 100.0 |
| #40 | 0.425 | 100.0 |
| #60 | 0.250 | 100.0 |
| #100 | 0.150 | 100.0 |
| #200 | 0.075 | 100.0 |

| HYDROMETER ANALYSIS | |
|---------------------|---------|
| Smaller than | Passing |
| 0.075mm | 40 |
| 0.002mm | 16 |
| 0.001mm | 0 |

| MATERIAL CLASSIFICATION | | |
|--|------------|---------|
| Type | Size (mm) | Percent |
| Gravel | >2mm | 0.0 |
| Coarse Sand | 2mm-4.75mm | 5.9 |
| Fine Sand | 4.75-75µm | 14.2 |
| Silt | 75-2µm | 62.9 |
| Clay | <2µm | 16.0 |
| Total Percent Silt & Clay (% Passing 75micron sieve) | | 78.9 |
| Colloids | <1µm | 0.0 |

GRAIN SIZE ACCUMULATION CURVE



TESTED BY (signature) COMPUTED BY (signature) CHECKED BY (signature)



P.O. Box 130, Comoro River Road, Dili, East Timor
 Tel. 001 670 3 313813, Fax. 0011 6703 312407
 Email: foynes@mtscade.com.au
 Web Site: www.mtsacade.com.au

MATERIALS TESTING CENTRE

| GRAIN - SIZE ANALYSIS (HYDROMETER METHOD) REPORT | | | | | | | | | |
|---|------------------------|--------------------------------|---|-----------|---|--|--------------------------|---------------|-----------|
| PROJECT : Vemasse River | | | LOCATION : Vemasse | | | DATE : 18-Dec-12 | | | |
| COORDINATES : (West or Down Stream) No. 01 | | | SAMPLE/SPECIMEN Soil (West or Down Stream) No. 01 | | | CLASSIFICATION : | | | |
| DISH NUMBER : D10 | | | CYLINDER ID. : C18 | | | HYDROMETER TYPE (151)H/152H : 152H | | | |
| DISPERSING AGENT USED : sodium hexametaphosphate | | | | | | QUANTITY : 125mL at 40g/L solution | | | |
| COMPOSITE CORRECTION : See calibration | | | DECIMAL FINES : 1.000 | | | SP. GR. OF SOLIDS, G/G* 2.49 | | | |
| Time (Minutes) | ELAPSED TIME (Minutes) | ACTUAL HYDROMETER READING (R1) | CORRECTED READING (R) | TEMP (°C) | TEMPERATURE AND SPECIFIC GRAVITY CONSTANT (K) | EFFECTIVE DEPTH (L) | PARTICLE DIAMETER (D),mm | PERCENT FINER | |
| | | | | | | | | (A) Partial | (B) Total |
| Start | 0:00 | - | - | - | - | - | - | - | - |
| 1 | 0:04 | 48 | 40 | 20 | 0.01431 | 8.7 | 0.045 | 82.4 | 82.4 |
| 2 | 0:08 | 45 | 36 | 20 | 0.01431 | 10.4 | 0.0321 | 78.20 | 78.3 |
| 5 | 0:15 | 43 | 35 | 20 | 0.01431 | 10.6 | 0.0208 | 72.1 | 72.1 |
| 15 | 0:35 | 39 | 31 | 20 | 0.01431 | 11.2 | 0.0124 | 63.86 | 63.9 |
| 30 | 0:50 | 37 | 28 | 20 | 0.01431 | 11.5 | 0.0089 | 59.74 | 59.7 |
| 60 | 0:50 | 34 | 26 | 20 | 0.01431 | 12.0 | 0.0064 | 53.98 | 53.9 |
| 90 | 0:50 | 32 | 24 | 20 | 0.01431 | 12.4 | 0.0053 | 49.44 | 49.4 |
| 240 | 1:45 | 27 | 18 | 20 | 0.01431 | 13.2 | 0.0033 | 36.4 | 36.1 |
| 1440 | 8:30 | 20 | 12 | 20 | 0.01431 | 14.3 | 0.0014 | 24.72 | 24.7 |

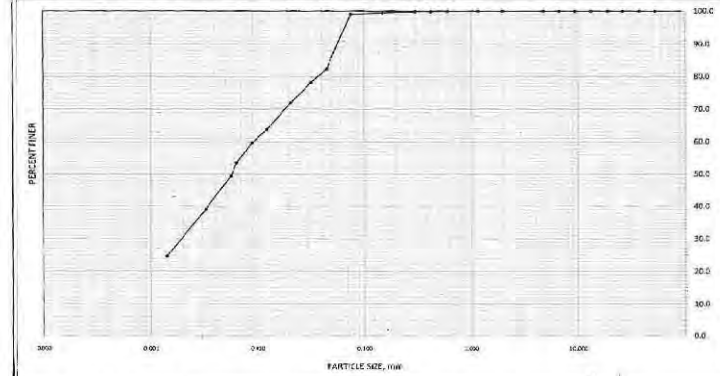
GRADATION:

| SIEVE SIZE | MM | Percent Passing |
|------------|-------|-----------------|
| ASTM #2 | 75.00 | 100.0 |
| #10 | 1.90 | 100.0 |
| -1/2" | 37.50 | 100.0 |
| #1 | 25.00 | 100.0 |
| 3/4" | 19.00 | 100.0 |
| #10 | 1.90 | 100.0 |
| #20 | 0.85 | 100.0 |
| #40 | 0.425 | 100.0 |
| #60 | 0.250 | 100.0 |
| #100 | 0.150 | 100.0 |
| #200 | 0.075 | 100.0 |

| HYDROMETER ANALYSIS | |
|---------------------|---------|
| Smaller than | Passing |
| 0.075mm | 71.2 |
| 0.002mm | 31 |
| 0.001mm | 0 |

| MATERIAL CLASSIFICATION | | |
|--|------------|---------|
| Type | Size (mm) | Percent |
| Gravel | >2mm | 0.0 |
| Coarse Sand | 2mm-4.75mm | 0.1 |
| Fine Sand | 4.75-75µm | 0.8 |
| Silt | 75-2µm | 68.1 |
| Clay | <2µm | 31.0 |
| Total Percent Silt & Clay (% Passing 75micron sieve) | | 99.1 |
| Colloids | <1µm | 0.0 |

GRAIN SIZE ACCUMULATION CURVE



TESTED BY (signature) COMPUTED BY (signature) CHECKED BY (signature)

A7-7



P.O. Box 130, Comoro River Road, Dili, East Timor
 Tel. 001 6703 313813, Fax. 0011 6703 312407
 E-mail: lypee@rmsaandc.com.au
 Web Site: www.rmsaandc.com.au

MATERIALS TESTING CENTRE

GRAIN - SIZE ANALYSIS (HYDROMETER METHOD) REPORT

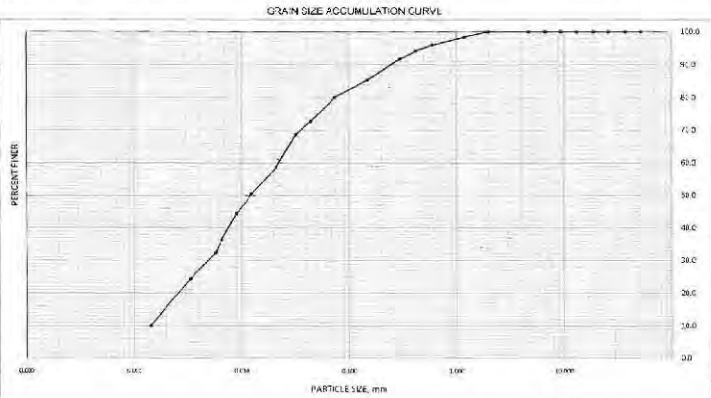
| | | | | | |
|---|--|--|--|--|--|
| PROJECT: Venesse River | | LOCATION: Venesse | | DATE: 19-Dec-12 | |
| COORDINATES: West or Down Stream (D2) | | SAMPLE SPECIMEN NUMBER: Soil/ West or Down Stream (D2) | | CLASSIFICATION: - | |
| DISH NUMBER: D11 | | CYLINDER ID: C2 | | HYDROMETER TYPE (H1H/152H): 152H | |
| DISPERSING AGENT USED: sodium hexametaphosphate | | QUANTITY: 125mL at 40g/L solution | | NP GR. OF 80 LBS, 6s ² : 2.65 | |
| COMPOSITE CORRECTION: See calibration | | DECIMAL FINES: 1.000 | | | |

| Time (Minutes) | ELAPSED TIME (Minutes) | ACTUAL HYDROMETER READING (R ₁) | CORRECTED READING (R) | TEMP (°C) | TEMPERATURE AND SPECIFIC GRAVITY CONSTANT (K) | EFFECTIVE DEPTH (L) | PARTICLE DIAMETER (D _u in μm) | PERCENT FINER | |
|----------------|------------------------|---|-----------------------|-----------|---|---------------------|--|---------------|-----------|
| | | | | | | | | (A) Partial | (B) Total |
| Start | 9:30 | | | | | | | | |
| 1 | 9:31 | 44 | 30 | 20 | 0.0135 | 10.4 | 0.045 | 72.72 | 72.7 |
| 2 | 9:32 | 42 | 34 | 20 | 0.0156 | 10.7 | 0.021 | 68.68 | 68.7 |
| 5 | 9:35 | 37 | 39 | 20 | 0.0156 | 11.5 | 0.0211 | 58.58 | 58.6 |
| 10 | 9:45 | 33 | 25 | 20 | 0.0180 | 12.2 | 0.025 | 50.5 | 50.5 |
| 30 | 10:00 | 30 | 22 | 20 | 0.0180 | 12.7 | 0.0300 | 44.44 | 44.4 |
| 60 | 10:30 | 26 | 18 | 20 | 0.0180 | 13.3 | 0.0365 | 36.36 | 36.4 |
| 90 | 10:50 | 24 | 16 | 20 | 0.0196 | 13.7 | 0.0367 | 32.32 | 32.3 |
| 250 | 1:40 | 20 | 12 | 20 | 0.0196 | 14.3 | 0.0333 | 24.24 | 24.2 |
| 400 | 2:30 | 19 | 9 | 20 | 0.0196 | 15.6 | 0.0214 | 11.1 | 10.1 |

| SIEVE SIZE | MM | Percent Passing |
|------------|-------|-----------------|
| 2 | 53.00 | 100.0 |
| 1-1/2" | 37.50 | 100.0 |
| 1" | 25.00 | 100.0 |
| 3/4" | 19.00 | 100.0 |
| 1/2" | 12.50 | 100.0 |
| 3/8" | 9.50 | 100.0 |
| 1/4" | 6.75 | 100.0 |
| #20 | 4.75 | 100.0 |
| #30 | 2.50 | 100.0 |
| #40 | 1.75 | 98.2 |
| #60 | 0.850 | 96.0 |
| #80 | 0.425 | 94.3 |
| #100 | 0.300 | 91.7 |
| #150 | 0.150 | 85.3 |
| #200 | 0.075 | 80.2 |

| Sieve Size | Passing |
|------------|---------|
| 0.075mm | 49.9 |
| 0.0075mm | 0 |

| Type | Size (mm) | Percent |
|---------------------------|-----------------------------|---------|
| Gravel | >2mm | 0.0 |
| Coarse Sand | mm-4.75 | 5.7 |
| Fine Sand | 4.75-75 μm | 14.1 |
| Silt | 75-2 μm | 65.0 |
| Clay | <2 μm | 15.2 |
| Total Fines (Silt & Clay) | (% Passing 75 micron sieve) | 80.2 |
| Coarse | >1 μm | 0.0 |



TESTED BY: (signature) COMPUTED BY: (signature) CHECKED BY: (signature)

A7 - 8



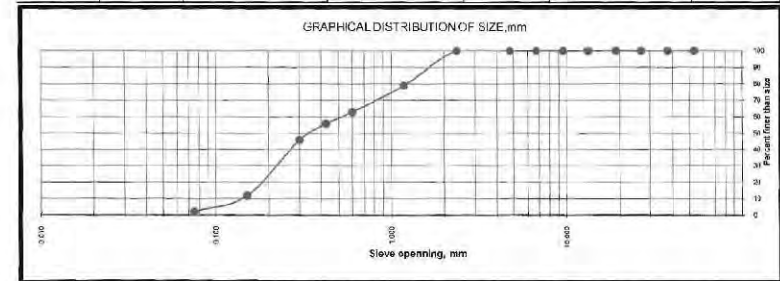
P.O. Box 130, Comoro River Road, Dili, East Timor
 Office Tel. +670 3 313813, Fax. +670 3 312407
 Email: atc@rmsaandc.com.au
 Web Site: www.rmsaandc.com.au

MATERIAL TESTING CENTRE

REPORT ON SOIL CLASSIFICATION

| | |
|---------------------------------|--------------------------------------|
| CLIENT: NTCI | TEST REPORT NO: RMS-QC-LAB-2012-4021 |
| PROJECT: Venesse River | DATE OF REPORT: 8-Jan-13 |
| PROJECT REF. NO: - | DATE RECEIVED: 5-Dec-12 |
| LOCATION: venesse | DATE TEST STARTED: 20-Dec-12 |
| SOURCE / MATERIAL TYPE: V.E. UP | DATE TEST FINISHED: 21-Dec-12 |
| DATE SAMPLED: 5-Dec-12 | TEST PERFORMED BY: Graci, Adu & Andy |
| SAMPLED BY: Client | TEST METHOD: Please see remarks. |

| SIEVE ANALYSIS | | Specification limits | | PROPERTIES 1 | Result | PROPERTIES 2 | Result |
|-----------------|-----------------|----------------------|-------------|-----------------------------|--------|--------------|--------|
| Sieve Size (mm) | Percent Passing | Lower Limit | Upper Limit | | | | |
| 53.00 | 100 | - | - | Natural Moisture Content, % | 6 | | |
| 37.50 | 100 | - | - | Liquid Limit, % | 0 | | |
| 25.00 | 100 | - | - | Plastic Limit, % | - | | |
| 19.00 | 100 | - | - | Plasticity Index, % | - | | |
| 13.20 | 100 | - | - | Shrinkage, % | - | | |
| 9.50 | 100 | - | - | Specific Gravity | 2.7 | | |
| 6.70 | 100 | - | - | | | | |
| 4.75 | 100 | - | - | | | | |
| 2.96 | 100 | - | - | | | | |
| 1.18 | 79 | - | - | | | | |
| 0.600 | 63 | - | - | | | | |
| 0.425 | 59 | - | - | | | | |
| 0.300 | 46 | - | - | | | | |
| 0.150 | 12 | - | - | | | | |
| 0.075 | 2.1 | - | - | | | | |



| | |
|---|--|
| REMARKS: This laboratory responsible for test only | <p>"This document shall not be reproduced except in full without written permission of RMS"</p> <p>Authorized Signatory</p> <p>Date as reported: () () () Manager / Engineer / Supervisor On Behalf of RMS - East Timor</p> |
|---|--|



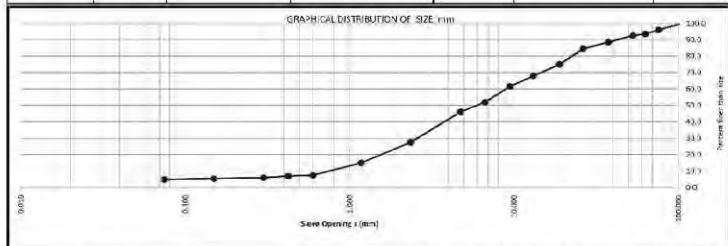
MATERIAL TESTING CENTRE

P.O. Box 130, Comoro River Road, Dili, East Timor
 Office Tel. +670 3 313813, Fax. +670 3 312487
 Email: lopee@rmsaandc.com.au
 Web Site: www.rmsaandc.com.au

REPORT ON SOIL CLASSIFICATION

| | | | |
|-------------------------|---------------------------------|---------------------|---------------------|
| CLIENT: | NTCI | TEST REPORT NO.: | RMS-QC-LAB-2012-482 |
| PROJECT: | Vemasse River | DATE OF REPORT: | 17-Dec-12 |
| PROJECT REF. NO.: | Not Applicable | DATE RECEIVED: | 4-Dec-12 |
| LOCATION: | Vemasse | DATE TEST STARTED: | 6-Dec-12 |
| SOURCE / MATERIAL TYPE: | Headrace Canal / River Material | DATE TEST FINISHED: | 8-Dec-12 |
| DATE SAMPLED: | 4-Dec-12 | TEST PERFORMED BY: | Graciano |
| SAMPLED BY: | Lope, Grazi & Andy | Test Method: | Please see remarks. |

| Sieve Size, mm | | Percent Passing | Specification limits | | PROPERTIES 1 | Result | PROPERTIES 2 | Result |
|----------------|------|-----------------|----------------------|-------------|-----------------------------|--------|--------------|--------|
| | | | Lower Limit | Upper Limit | | | | |
| 106.00 | 100 | - | - | - | Natural Moisture Content, % | - | | |
| 75.70 | 96 | - | - | - | Liquid Limit, % | - | | |
| 53.00 | 93.5 | - | - | - | Plastic Limit, % | - | | |
| 53.00 | 92.5 | - | - | - | Plasticity Index, % | - | | |
| 37.50 | 88.5 | - | - | - | Emerson Class No. | - | | |
| 25.50 | 84.5 | - | - | - | Specific Gravity | - | | |
| 19.00 | 75 | - | - | - | | | | |
| 13.20 | 68 | - | - | - | | | | |
| 9.50 | 61.5 | - | - | - | | | | |
| 6.70 | 52 | - | - | - | | | | |
| 4.75 | 46 | - | - | - | | | | |
| 2.36 | 27.5 | - | - | - | | | | |
| 1.18 | 15 | - | - | - | | | | |
| 0.600 | 7.5 | - | - | - | | | | |
| 0.425 | 7 | - | - | - | | | | |
| 0.300 | 6 | - | - | - | | | | |
| 0.150 | 5.5 | - | - | - | | | | |
| 0.075 | 5.0 | - | - | - | | | | |



REMARKS

WELL GRADED GRAVEL (GW)
 About 27% of fine to coarse rounded sand, around 72% of fine to coarse rounded gravel with cobbles and around 1% of fines.

"This document shall not be reproduced except in full without written permission of RMS"
 Authorized Signatory
 (Signature)
 (Manager / Engineer / Supervisor)
 On-Behalf of RMS - East Timor



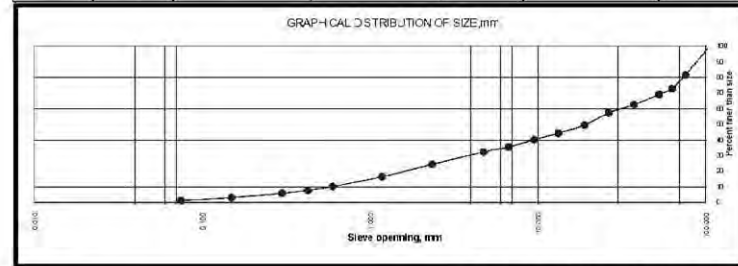
MATERIAL TESTING CENTRE

P.O. Box 130, Comoro River Road, Dili, East Timor
 Office Tel. +670 3 313813, Fax. +670 3 312487
 Email: lopee@rmsaandc.com.au
 Web Site: www.rmsaandc.com.au

REPORT ON SOIL CLASSIFICATION

| | | | |
|-------------------------|--------------------------------|---------------------|---------------------|
| CLIENT: | NTCI | TEST REPORT NO.: | RMS-QC-LAB-2012-483 |
| PROJECT: | Vemasse River | DATE OF REPORT: | 17-Dec-12 |
| PROJECT REF. NO.: | Not Applicable | DATE RECEIVED: | 4-Dec-12 |
| LOCATION: | Vemasse | DATE TEST STARTED: | 6-Dec-12 |
| SOURCE / MATERIAL TYPE: | Sediment trap / River Material | DATE TEST FINISHED: | 8-Dec-12 |
| DATE SAMPLED: | 4-Dec-12 | TEST PERFORMED BY: | Graciano |
| SAMPLED BY: | Lope, Grazi & Andy | TEST METHOD: | Please see remarks. |

| Sieve Size, mm | Percent Passing | Specification limits | | PROPERTIES 1 | Result | PROPERTIES 2 | Result |
|----------------|-----------------|----------------------|-------------|-----------------------------|--------|--------------|--------|
| | | Lower Limit | Upper Limit | | | | |
| 106.00 | 100 | - | - | Natural Moisture Content, % | - | | |
| 75.70 | 82 | - | - | Liquid Limit, % | - | | |
| 53.00 | 73 | - | - | Plastic Limit, % | - | | |
| 53.00 | 69 | - | - | Plasticity Index, % | - | | |
| 37.50 | 63 | - | - | Emerson Class No. | - | | |
| 26.50 | 57 | - | - | Specific Gravity | - | | |
| 19.00 | 50 | - | - | | | | |
| 13.20 | 44 | - | - | | | | |
| 9.50 | 40 | - | - | | | | |
| 6.70 | 38 | - | - | | | | |
| 4.75 | 33 | - | - | | | | |
| 2.36 | 25 | - | - | | | | |
| 1.18 | 17 | - | - | | | | |
| 0.600 | 10 | - | - | | | | |
| 0.425 | 8 | - | - | | | | |
| 0.300 | 6 | - | - | | | | |
| 0.150 | 3 | - | - | | | | |
| 0.075 | 1.4 | - | - | | | | |



REMARKS

WELL GRADED GRAVEL (GW)
 About 72% of fine to coarse rounded sand, around 72% of fine to coarse rounded gravel with cobbles and around 1% of fines.

"This document shall not be reproduced except in full without written permission of RMS"
 Authorized Signatory
 (Signature)
 (Manager / Engineer / Supervisor)
 On-Behalf of RMS - East Timor



MATERIAL TESTING CENTRE

P.O. Box 130, Comoro River Road, Dili, East Timor
 Office Tel. +670 3 313813, Fax. +670 3 312407
 Email: lopes@rmseandc.com.au
 Web Site: www.rmseandc.com.au



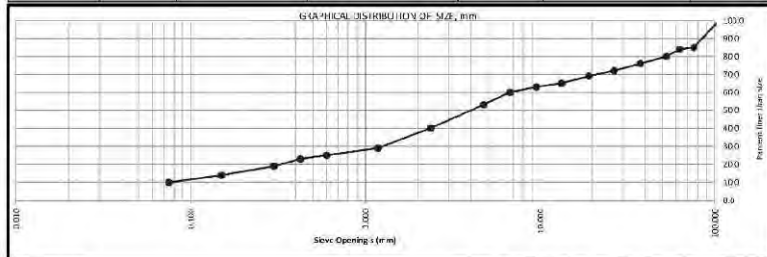
MATERIAL TESTING CENTRE

P.O. Box 130, Comoro River Road, Dili, East Timor
 Office Tel. +670 3 313813, Fax. +670 3 312407
 Email: lopes@rmseandc.com.au
 Web Site: www.rmseandc.com.au

REPORT ON SOIL CLASSIFICATION

| | | | |
|--------------------------|-------------------|---------------------|---------------------|
| CLIENT: | NTCI | TEST REPORT NO.: | RMS-QC-LAB-2012-482 |
| PROJECT: | Vamasse River | DATE OF REPORT.: | 17-Dec-12 |
| PROJECT REF. NO.: | Not Applicable | DATE RECEIVED: | 4-Dec-12 |
| LOCATION: | Vamasse | DATE TEST STARTED: | 6-Dec-12 |
| SOURCE / MATERIAL TYPE.: | Main Canal | DATE TEST FINISHED: | 8-Dec-12 |
| DATE SAMPLED.: | 4-Dec-12 | TEST PERFORMED BY.: | Graciano |
| SAMPLED BY.: | Lope, Grad & Andy | Test Method.: | Please see remarks |

| SIEVE ANALYSIS | | | | | | | |
|----------------|-----------------|----------------------|-------------|-----------------------------|--------|--------------|--------|
| Sieve Size, mm | Percent Passing | Specification limits | | PROPERTIES 1 | Result | PROPERTIES 2 | Result |
| | | Lower Limit | Upper Limit | | | | |
| 106.00 | 100 | - | - | Natural Moisture Content, % | - | | |
| 75.70 | 85 | - | - | Liquid Limit, % | - | | |
| 63.00 | 84 | - | - | Plastic Limit, % | - | | |
| 53.00 | 80 | - | - | Flakiness Limit, % | - | | |
| 37.50 | 76 | - | - | Emerson Class No. | - | | |
| 26.50 | 72 | - | - | Specific Gravity | - | | |
| 19.00 | 69 | - | - | | | | |
| 13.20 | 65 | - | - | | | | |
| 9.50 | 63 | - | - | | | | |
| 6.70 | 60 | - | - | | | | |
| 4.75 | 53 | - | - | | | | |
| 2.36 | 40 | - | - | | | | |
| 1.18 | 29 | - | - | | | | |
| 0.600 | 25 | - | - | | | | |
| 0.425 | 23 | - | - | | | | |
| 0.300 | 19 | - | - | | | | |
| 0.150 | 14 | - | - | | | | |
| 0.075 | 10.0 | - | - | | | | |



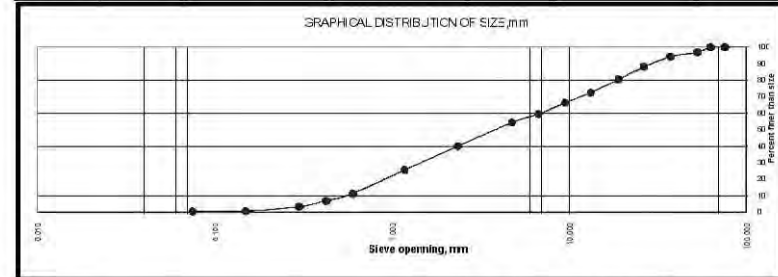
REMARKS:
WELL GRADED GRAVEL (GW)
 About 27% of fine to coarse rounded sand, around 72% of fine to coarse rounded gravel with cobbles and around 1% of fines.

"This document shall not be reproduced except in full without written permission of RMS"
 Authorized Signatory
 (Date as appropriate) Manager / Engineer / Supervisor
 On-Behalf of RMS - East Timor

REPORT ON SOIL CLASSIFICATION

| | | | | |
|--------------------------|-------------------------|---------------------|---------------------|----------|
| CLIENT: | NTCI | TEST REPORT NO.: | RMS-QC-LAB-2012-484 | |
| PROJECT: | Vamasse River | DATE OF REPORT.: | 17-Dec-12 | |
| PROJECT REF. NO.: | Not Applicable | DATE RECEIVED: | 4-Dec-12 | |
| LOCATION: | Vamasse | DATE TEST STARTED: | 6-Dec-12 | |
| SOURCE / MATERIAL TYPE.: | Intake Site River Right | River Material | DATE TEST FINISHED: | 8-Dec-12 |
| DATE SAMPLED.: | 4-Dec-12 | TEST PERFORMED BY.: | Graciano | |
| SAMPLED BY.: | Client | TEST METHOD.: | Please see remarks | |

| SIEVE ANALYSIS | | | | | | | |
|----------------|-----------------|----------------------|-------------|-----------------------------|--------|--------------|--------|
| Sieve Size,mm | Percent Passing | Specification limits | | PROPERTIES 1 | Result | PROPERTIES 2 | Result |
| | | Lower Limit | Upper Limit | | | | |
| 106.00 | 100 | - | - | Natural Moisture Content, % | - | | |
| 75.70 | 100 | - | - | Liquid Limit, % | - | | |
| 63.00 | 100 | - | - | Plastic Limit, % | - | | |
| 53.00 | 97 | - | - | Plasticity Index, % | - | | |
| 37.50 | 94 | - | - | Emerson Class No. | - | | |
| 26.50 | 88 | - | - | Specific Gravity | - | | |
| 19.00 | 81 | - | - | | | | |
| 13.20 | 72 | - | - | | | | |
| 9.50 | 66 | - | - | | | | |
| 6.70 | 59 | - | - | | | | |
| 4.75 | 54 | - | - | | | | |
| 2.36 | 40 | - | - | | | | |
| 1.18 | 26 | - | - | | | | |
| 0.600 | 11 | - | - | | | | |
| 0.425 | 7 | - | - | | | | |
| 0.300 | 3 | - | - | | | | |
| 0.150 | 1 | - | - | | | | |
| 0.075 | 0.5 | - | - | | | | |



REMARKS:
WELL GRADED SAND WITH GRAVEL (SW)
 About 54% of fine to coarse rounded sand, around 46% of fine to coarse rounded gravel and around 0.5% of fines. Gray color

"This document shall not be reproduced except in full without written permission of RMS"
 Authorized Signatory
 (Date as appropriate) Manager / Engineer / Supervisor
 On-Behalf of RMS - East Timor



MATERIAL TESTING CENTRE

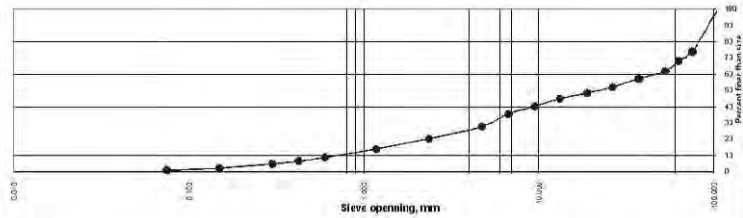
P.O. Box 130, Comoro River Road, Dili, East Timor
 Office Tel. +670 3 313813, Fax. +670 3 312407
 E-mail: lopez@rmsandc.com.au
 Web Site: www.rmsandc.com.au

REPORT ON SOIL CLASSIFICATION

| | | | | |
|-------------------------|---------------------|----------------|---------------------|---------------------|
| CLIENT: | NTCI | | TEST REPORT NO: | RMS-QC-LAB-2012-482 |
| PROJECT: | Vemasse River | | DATE OF REPORT: | 17-Dec-12 |
| PROJECT REF. NO: | Not Applicable | | DATE RECEIVED: | 4-Dec-12 |
| LOCATION: | Vemasse | | DATE TEST STARTED: | 6-Dec-12 |
| SOURCE / MATERIAL TYPE: | River Left Surface | River Material | DATE TEST FINISHED: | 8-Dec-12 |
| DATE SAMPLED: | 4-Dec-12 | | TEST PERFORMED BY: | Graciano |
| SAMPLED BY: | Lopez, Graci & Andy | | TEST METHOD: | Please see remarks. |

| Sieve Analysis | | Specification limits | | PROPERTIES 1 | Result | PROPERTIES 2 | Result |
|----------------|-----------------|----------------------|-------------|-----------------------------|--------|--------------|--------|
| Sieve Size,mm | Percent Passing | Lower Limit | Upper Limit | | | | |
| 106.00 | 100 | - | - | Natural Moisture Content, % | - | | |
| 75.73 | 74 | - | - | Liquid Limit, % | - | | |
| 63.00 | 68 | - | - | Plastic Limit, % | - | | |
| 53.00 | 62 | - | - | Plasticity Index, % | - | | |
| 37.50 | 57 | - | - | Emerson Class No. | - | | |
| 26.50 | 52 | - | - | Specific Gravity | - | | |
| 19.00 | 48 | - | - | | | | |
| 13.20 | 45 | - | - | | | | |
| 9.50 | 40 | - | - | | | | |
| 6.75 | 36 | - | - | | | | |
| 4.75 | 28 | - | - | | | | |
| 2.36 | 20 | - | - | | | | |
| 1.18 | 14 | - | - | | | | |
| 0.600 | 9 | - | - | | | | |
| 0.425 | 7 | - | - | | | | |
| 0.300 | 5 | - | - | | | | |
| 0.150 | 2 | - | - | | | | |
| 0.075 | 1.0 | - | - | | | | |

GRAPHICAL DISTRIBUTION OF SIZE,mm



REMARKS:

WELL GRADED GRAVEL (GW)
 About 27% of fine to coarse rounded sand, around 72% of fine to coarse rounded gravel with cobbles and around 1% of fines.

"This document shall not be reproduced except in full without written permission of RMS"

Authorized Signatory

Date: as appropriate (Manager / Engineer / Supervisor)
 On-Behalf of RMS - East Timor



MATERIAL TESTING CENTRE

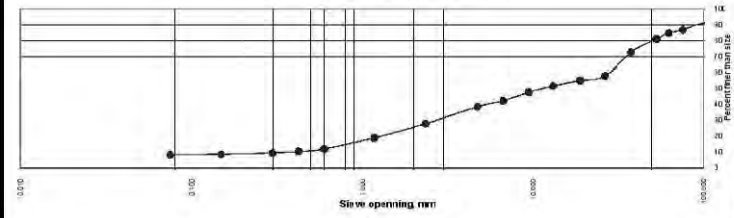
P.O. Box 130, Comoro River Road, Dili, East Timor
 Office Tel. +670 3 313813, Fax. +670 3 312407
 E-mail: lopez@rmsandc.com.au
 Web Site: www.rmsandc.com.au

REPORT ON SOIL CLASSIFICATION

| | | | | |
|-------------------------|---------------------------|----------------|---------------------|---------------------|
| CLIENT: | NTCI | | TEST REPORT NO: | RMS-QC-LAB-2012-485 |
| PROJECT: | Vemasse River | | DATE OF REPORT: | 17-Dec-12 |
| PROJECT REF. NO: | Not Applicable | | DATE RECEIVED: | 4-Dec-12 |
| LOCATION: | Vemasse | | DATE TEST STARTED: | 6-Dec-12 |
| SOURCE / MATERIAL TYPE: | Initial Site River Middle | River Material | DATE TEST FINISHED: | 8-Dec-12 |
| DATE SAMPLED: | 4-Dec-12 | | TEST PERFORMED BY: | Graciano |
| SAMPLED BY: | Client | | TEST METHOD: | Please see remarks. |

| Sieve Analysis | | Specification limits | | PROPERTIES 1 | Result | PROPERTIES 2 | Result |
|----------------|-----------------|----------------------|-------------|-----------------------------|--------|--------------|--------|
| Sieve Size,mm | Percent Passing | Lower Limit | Upper Limit | | | | |
| 300.00 | 100 | - | - | Natural Moisture Content, % | - | | |
| 106.00 | 92 | - | - | Liquid Limit, % | - | | |
| 75.70 | 87 | - | - | Plastic Limit, % | - | | |
| 63.00 | 85 | - | - | Plasticity Index, % | - | | |
| 53.00 | 81 | - | - | Emerson Class No. | - | | |
| 37.50 | 73 | - | - | Specific Gravity | - | | |
| 26.50 | 58 | - | - | | | | |
| 19.00 | 55 | - | - | | | | |
| 13.20 | 52 | - | - | | | | |
| 9.50 | 48 | - | - | | | | |
| 6.70 | 42 | - | - | | | | |
| 4.75 | 39 | - | - | | | | |
| 2.36 | 28 | - | - | | | | |
| 1.18 | 19 | - | - | | | | |
| 0.600 | 12 | - | - | | | | |
| 0.425 | 11 | - | - | | | | |
| 0.300 | 10 | - | - | | | | |
| 0.150 | 9 | - | - | | | | |
| 0.075 | 8.5 | - | - | | | | |

GRAPHICAL DISTRIBUTION OF SIZE,mm



REMARKS:

WELL GRADED SAND WITH GRAVEL (SW)
 About 54% of fine to coarse rounded sand, around 43% of fine to coarse rounded gravel and around 0.5% of fines. Gray color

"This document shall not be reproduced except in full without written permission of RMS"

Authorized Signatory

Date: as appropriate (Manager / Engineer / Supervisor)
 On-Behalf of RMS - East Timor

A7 - 11



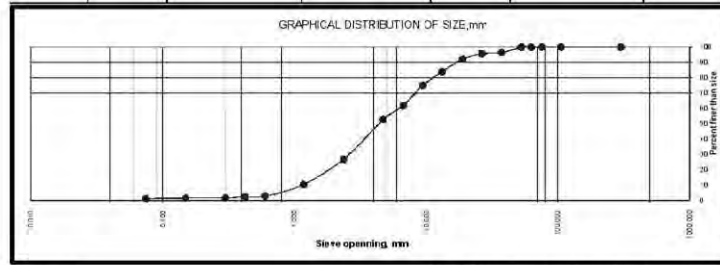
MATERIAL TESTING CENTRE

P.O. Box 130, Comoro River Road, Dili, East Timor
 Office Tel. +670 3 313813, Fax. +670 3 312407
 E-mail: lopes@rmsandc.com.au
 Web Site: www.rmsandc.com.au

REPORT ON SOIL CLASSIFICATION

| | | | | |
|------------------------|---------------------------------|----------------|---------------------|---------------------|
| CLIENT | NTCI | | TEST REPORT NO | RMS-QC-LAB-2012-486 |
| PROJECT | Vemasse River | | DATE OF REPORT | 17-Dec-12 |
| PROJECT REF. NO. | Not Applicable | | DATE RECEIVED | 4-Dec-12 |
| LOCATION | Vemasse | | DATE TEST STARTED | 6-Dec-12 |
| SOURCE / MATERIAL TYPE | Inake Site River Middle Surface | River Material | DATE TEST FINISHED | 8-Dec-12 |
| DATE SAMPLED | 4-Dec-12 | | TEST PERFORMED BY | Graciano |
| SAMPLED BY | Client | TEST METHOD | Please see remarks. | |

| SIEVE ANALYSIS | | Specification limits | | PROPERTIES 1 | Result | PROPERTIES 2 | Result |
|----------------|-----------------|----------------------|-------------|-----------------------------|--------|--------------|--------|
| Sieve Size mm | Percent Passing | Lower Limit | Upper Limit | | | | |
| 300.00 | 100 | - | - | Natural Moisture Content, % | - | | |
| 105.00 | 100 | - | - | Liquid Limit, % | - | | |
| 75.70 | 100 | - | - | Plastic Limit, % | - | | |
| 63.00 | 100 | - | - | Plasticity Index, % | - | | |
| 43.00 | 100 | - | - | Emerson Class No. | - | | |
| 37.50 | 96 | - | - | Specific Gravity | - | | |
| 26.50 | 96 | - | - | | | | |
| 19.00 | 92 | - | - | | | | |
| 13.20 | 84 | - | - | | | | |
| 9.50 | 75 | - | - | | | | |
| 6.70 | 62 | - | - | | | | |
| 4.75 | 53 | - | - | | | | |
| 2.36 | 27 | - | - | | | | |
| 1.18 | 11 | - | - | | | | |
| 0.600 | 3 | - | - | | | | |
| 0.425 | 3 | - | - | | | | |
| 0.300 | 2 | - | - | | | | |
| 0.150 | 2 | - | - | | | | |
| 0.075 | 1.4 | - | - | | | | |



REMARKS:
WELL GRADED GRAVEL WITH SAND (GW)
 About 52% of fine to coarse rounded sand, around 47% of fine to coarse rounded gravel with cobbles and around 1.4% of fines. Gray color.

"This document shall not be reproduced except in full without written permission of RMS"
 Authorized Signatory
 (Manager / Engineer / Supervisor)
 On Behalf of RMS - East Timor



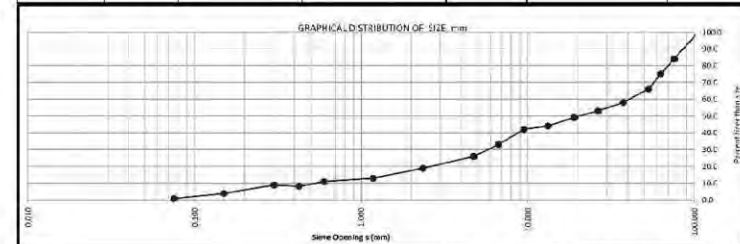
MATERIAL TESTING CENTRE

P.O. Box 130, Comoro River Road, Dili, East Timor
 Office Tel. +670 3 313813, Fax. +670 3 312407
 Email: lopes@rmsandc.com.au
 Web Site: www.rmsandc.com.au

REPORT ON SOIL CLASSIFICATION

| | | | | |
|------------------------|--------------------|----------------|---------------------|---------------------|
| CLIENT | NTCI | | TEST REPORT NO | RMS-QC-LAB-2012-482 |
| PROJECT | Vemasse River | | DATE OF REPORT | 17-Dec-12 |
| PROJECT REF. NO. | Not Applicable | | DATE RECEIVED | 4-Dec-12 |
| LOCATION | Vemasse | | DATE TEST STARTED | 6-Dec-12 |
| SOURCE / MATERIAL TYPE | Dike Protection | River Material | DATE TEST FINISHED | 8-Dec-12 |
| DATE SAMPLED | 4-Dec-12 | | TEST PERFORMED BY | Graciano |
| SAMPLED BY | Lopo, Graci & Andy | Test Method | Please see remarks. | |

| SIEVE ANALYSIS | | Specification limits | | PROPERTIES 1 | Result | PROPERTIES 2 | Result |
|----------------|-----------------|----------------------|-------------|-----------------------------|--------|--------------|--------|
| Sieve Size, mm | Percent Passing | Lower Limit | Upper Limit | | | | |
| 106.00 | 100 | - | - | Natural Moisture Content, % | - | | |
| 75.70 | 84 | - | - | Liquid Limit, % | - | | |
| 63.00 | 75 | - | - | Plastic Limit, % | - | | |
| 53.00 | 66 | - | - | Plasticity Index, % | - | | |
| 37.50 | 58 | - | - | Emerson Class No. | - | | |
| 26.50 | 53 | - | - | Specific Gravity | - | | |
| 19.00 | 49 | - | - | | | | |
| 13.20 | 44 | - | - | | | | |
| 9.50 | 42 | - | - | | | | |
| 6.70 | 33 | - | - | | | | |
| 4.75 | 26 | - | - | | | | |
| 2.36 | 19 | - | - | | | | |
| 1.18 | 13 | - | - | | | | |
| 0.600 | 11 | - | - | | | | |
| 0.425 | 8.2 | - | - | | | | |
| 0.300 | 9 | - | - | | | | |
| 0.150 | 4 | - | - | | | | |
| 0.075 | 1 | - | - | | | | |



REMARKS:
WELL GRADED GRAVEL (GW)
 About 27% of fine to coarse rounded sand, around 72% of fine to coarse rounded gravel with cobbles and around 1% of fines.

"This document shall not be reproduced except in full without written permission of RMS"
 Authorized Signatory
 (Manager / Engineer / Supervisor)
 On Behalf of RMS - East Timor

A7 - 12

資料 8 流量観測結果

PEC Consulting, LDA

Final Report July 2013



Buluto Hydrological Survey and Data Collection

- Final Report
- July 2013

Prepared for NTC International Consultant, INC.

Prepared by PEC-Consulting, LDA



Table of Contents

| | |
|---|-----------|
| 1. Summary | 2 |
| 2. Introduction and Scopes | 3 |
| 2.1 Background | 3 |
| 2.2 Project Site | 3 |
| 2.3 Scope of Works | 5 |
| 3. Data Collection and Analysis | 6 |
| 3.1 Field Reconnaissance | 6 |
| 3.2 Baseline data and Established sites | 6 |
| 3.3 Daily Water Stage Observation | 12 |
| 3.4 Bi-Monthly Observation | 33 |
| 3.5 High Flow Observation | 35 |
| 3.6 Scatter Plot of H-Q relation | 36 |
| 4. Stage- Discharge and Discharge Calculation | 39 |
| 4.1 Rating Curve (H versus Q) | 39 |
| 4.2 Daily Discharge Calculation | 39 |
| 4.3 Manning's Coefficient Estimation | 46 |
| 4.4 Design Flood Height Estimation | 52 |
| 5. Finding and Conclusions Remarks | 54 |
| 6. Annexes | 54 |
| 6.1 Data Table (Excel file)- File attached | 54 |
| 6.2 Figures | 54 |
| 6.3 Digital Photographs (Digital file attached) | 54 |



2. Introduction and Scopes

2.1 Background

Government of Timor Leste (GoTL) has asked technical assistance to JICA for irrigation system rehabilitation in order to increase the rice production that is low across the nation. The Buluto irrigation scheme locates at the boundary of the Manatuto and Baucau Districts is one of those irrigation schemes.

Present intakes have been constructed with riverbed material with fascine; hence intake capacity was unstable due to destruction of the intake facilities and deposition of the river sediment in the canal. The rehabilitation of the existing irrigation facilities will effectively improve water supply condition to the beneficial area. In response to the request by the Government of RDTL, the Japan International Cooperation (JICA) has been implementing the Preparatory Survey on the Project for Rehabilitation and Improvement of Buluto Irrigation Scheme has been from October 2012.

Hydrological survey is part of the preparatory survey that will provide the hydrological data for a reliable design of the irrigation system. In November, 12, 2012, NTC (Consultant Company on behalf of JICA) engaged the PEC-Consulting LDA to conduct the hydrological data collection for the project, which include field work of gauge meter installation in the pears, and continue monitoring and data collection from period of November 2012- June 2013. Furthermore, make of collected data to develop hydrological rating curve for Laleia River

This final report is the summary of hydrological data collection and the use of data for developing the design curve of hydrological flow estimation. More importantly, the data collected by this work was also used to determine the flow resistance of the river which was further used in the estimation of the maximum water depth of the selected return period of flood.

2.2 Project Site

The measurement site locates at Laleia River at the Laleia Bridge, as can be seen from figure 1 below. The total width of Laleia River is roughly 180 meter and several small streams do exist during the low flow condition. The total flow contributing area into the measurement point (catchment) was estimated to be 537 km², which is considered as a large catchment.

Considering the wide of the river and existing of small stream that forms the entire Laleia River, the measurement gauge was established by following the existence of the small streams. Three measurement gauges were established to accommodate the small streams and wide river section.



Figure 1. Project Site and Laleia Catchment System



This lowest point of the measurement is also the concentrated flow in Laleia River. Roughly, the condition of the river bed can be represented in the following figure.

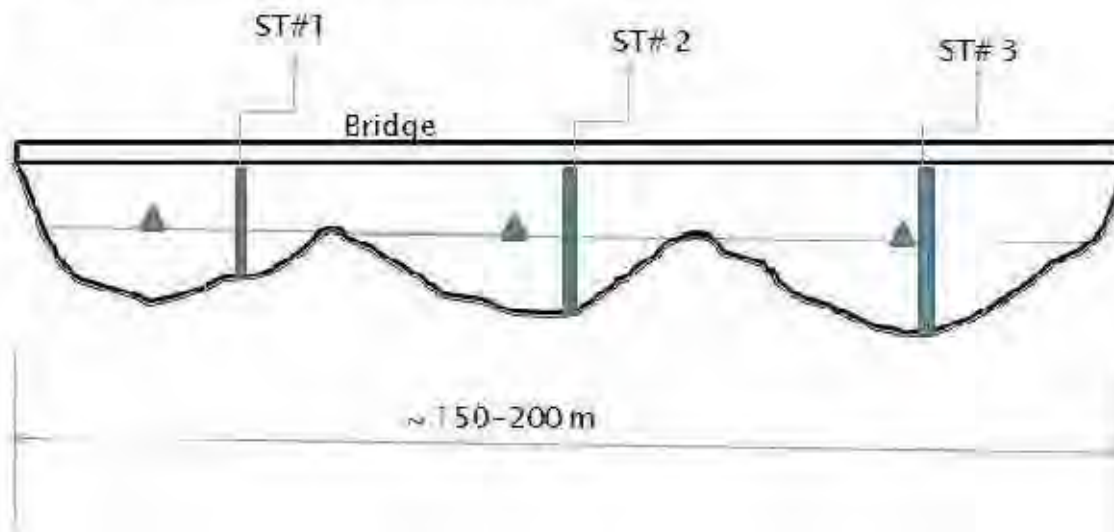
Figure 2 Sub-Section of Laleia River for Hydrological Survey Purpose





It was measured that the distance of one pier to the next is roughly about 15.57 meters and total piers are 11, exclude the two concrete structures at both side of the river bank (left and right banks). Therefore, the total length was determined to be 180 m. Considering the width of River and exiting small stream, it was decided to place the measurement meters in three different place, which also known as station (ST). The measurement sites were conceptually, represented by the following figure.

Figure 3. Measurement section in Laleia River



The baseline data of each station such as zero elevation of meter and invert elevation need to be determined. The topographical survey was conducted to collect the baseline data for the further calculation of the actual water depth.

3.3 Scope of Work:

The purpose of the discharge measurement survey is to obtain the flow condition of the Laleia River that is main water source for the Buluto Irrigation Scheme. The survey is composed of following Works:

- o Installation of meters in the river segment
- o Water Stage Observation
- o Velocity Measurement
- o Cross section area estimation
- o Rating Curve
- o Discharge Estimation
- o Manning's Coefficient Estimation



3. Data Collection and Analysis

3.1 Field Reconnaissance

Field reconnaissance was conducted by PEC-Consulting team to the site in order to collect the necessary information in the field installation phase and also to set a common agreement/understanding between the PEC-consulting and NTC project team. In addition, the field trip was also to introduce the project to local leaders such as chief Suco, the head of police sub-station, and some degree of wider community, who will be a beneficiary to the project in many years to come.

Moreover, some baseline data related the River system was observed which give an information to design the measurement units such as how many small stream exist in the low flow condition. The following facts were observed the field reconnaissance:

1. River width is big, with effective flow width roughly 120-190 meters
2. The river bed consist of boulder, sand, silt, and very small degree of plants
3. Two -small streams during the low flow condition do exist
4. The water level measurement were decided to be placed in the lowest point in each small stream
5. Additional measurement section was decided at the end of the bank (eastside of River)
6. Some desktop investigation was conducted to determine the contributing area of watershed, which is 537 KM²

3.2 Baseline data and Established sites

As indicated from the previous sub-section that three measurement section were decided and the meters need to be placed in each section so that the level of water can be read. The selected point of measurement was next to a pier, as the meter will be bolted unto the pier. The important basic information is:

- Elevation of the zero value of meter
- Elevation of the lowest point of the stream

The meters were installed in each sub-section of the river to collect the water level data. The generator and hummer drill were deployed from Dili by the PEC-Consulting team to install the meter onto the wall of each pier.



Figure 4 Water-Stage meter



The gauge meter was made from metal sheet with the scale as shown from the above figure, with the maximum 1 meter. Because the maximum depth of the river is roughly 3 meter, four gauge meters would be needed in each subsection, By installing one gauge meter unto the top of another's. The procedure of installation is summarized as follows:

- Drill the hole unto the wall with the equal size drill pits with the bolts

Figure 5 Using Hammer Drill to drill holes to place the bolts





- Put the meter onto the wall and puts nuts, washers onto the bolts

Figure 6. Bolt the meters unto the wall



- Write the actual height of the meter from bottom to top

Figure 6. Re-scale the meter gauges





The stage-meter in each sub-section can be seen from the following figures:

Figure 7. Station #1 (sub-Section 1) at the pier no.1



At the first station, the zero reading stage begins at 0.4 meter above the existing water table. The water depth was measured to be around 0.1 meter (10 cm). The elevation value at zero reading was measured to be 21.25 m and therefore the invert elevation of this channel was about 20.75 meter.

The second measurement station was placed at the pier #3. Most of existing water flows in this sub-section and also the sub-section seems to be the lowest river bed. The zero reading of the stage-meter was placed above the water table and the maximum depth of the existing water table was measured to be 0.2 meter.



Figure 8. Station #2 at the pier no. 3



The elevation at zero reading of stage was estimated to be 20.2 m and therefore the invert elevation of this sub-section of the river bed was calculated to be 20 m

The third or last station proposed was located at the end of the river or pier #11, (closed to the other end of the river). The condition of existing sub-section has no flow and the level is well above the other two sub-sections.



Figure 9 Station #3 at Pier no. 11 (near the river bank)





The elevation at zero reading of stage was estimated to be 21.25 m and therefore the invert elevation of this sub-section of the river bed was calculated to be 20.4 m

Summary of basic information of each point of measurement:

Table 1: Basic information of each Station

| Station | Elevation | Invert Elevation, m | Zero-depth, m |
|-------------------|-----------|---------------------|---------------|
| ST-1 at pier # 1 | 21.25 | 20.85 | 0.4 |
| ST-2 at pier # 3 | 20.2 | 19.85 | 0.35 |
| ST-3 at pier # 11 | 21.25 | 20.7 | 0.55 |

The above table will be very useful in the actual value of water depth, from the water level read by the meters installed above. For instance, if the water level reading at meter says 1 meter for station #1, means that the absolute water depth is equal to 1.4 meters. This is only the case for no siltation and condition remains the same as compares to the original system.

3.3 Daily Water Stage Observation

Once the meters were installed in the station, one can read the water level. Stage reading of water level will be conducted twice a day, at 9 a.m. and 5 p.m. every day from period of November 17, 2012 to June 30 2013. Reading will start on November 17, 2012 and continues to June 30, 2013. A designated reader will be hired locally in Laleia and trained to perform the task. Results from the reading will be reported weekly to the contractor's team every month. The following table show the raw data of the water level measured from the meter installed for each station.

Table 2: Raw Data of Daily Reading of Stage level

| No | DD/MM/YYYY | TIME | ST # 1, m | ST # 2, m | ST # 3, m |
|----|------------|-------|-----------|-----------|-----------|
| 1 | 17/11/2012 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 2 | 18/11/2012 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 3 | 19/11/2012 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 4 | 20/11/2012 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 5 | 21/11/2012 | 9:00 | 0 | 0 | 0 |



| | | | | | |
|----|------------|-------|------|------|---|
| | | 17:00 | 0 | 0 | 0 |
| 6 | 22/11/2012 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 7 | 23/11/2012 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 8 | 24/11/2012 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 9 | 25/11/2012 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0.02 | 0.40 | 0 |
| 10 | 26/11/2012 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 11 | 27/11/2012 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 12 | 28/11/2012 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 13 | 29/11/2012 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0.40 | 1.6 | 0 |
| 14 | 30/11/2012 | 9:00 | 0 | 0.20 | 0 |
| | | 17:00 | 0 | 0.84 | 0 |
| 15 | 1/12/2012 | 9:00 | 0 | 0.12 | 0 |
| | | 17:00 | 0 | 0.6 | 0 |
| 16 | 2/12/2012 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0.40 | 0.10 | 0 |
| 17 | 3/12/2012 | 9:00 | 0 | 0.2 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 18 | 4/12/2012 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 19 | 5/12/2012 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 20 | 6/12/2012 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 21 | 7/12/2012 | 9:00 | 0 | 0.10 | 0 |
| | | 17:00 | 0.10 | 0.6 | 0 |
| 22 | 8/12/2012 | 9:00 | 0 | 0.4 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 23 | 9/12/2012 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 24 | 10/12/2012 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0.8 | 0 |
| 25 | 11/12/2012 | 9:00 | 0.2 | 0.18 | 0 |
| | | 17:00 | 0 | 0.10 | 0 |



| | | | | | |
|----|------------|-------|-------|------|---|
| 26 | 12/12/2012 | 9:00 | 0 | 0.14 | 0 |
| | | 17:00 | 0.6 | 0.12 | 0 |
| 27 | 13/12/2012 | 9:00 | 0.2 | 0.16 | 0 |
| | | 17:00 | 0.10 | 0.12 | 0 |
| 28 | 14/12/2012 | 9:00 | 0.2 | 0.10 | 0 |
| | | 17:00 | 0 | 0.80 | 0 |
| 29 | 15/12/2012 | 9:00 | 0 | 0.40 | 0 |
| | | 17:00 | 0.80 | 1.m | 0 |
| 30 | 16/12/2012 | 9:00 | 0.40 | 0.80 | 0 |
| | | 17:00 | 0.8 | 0.20 | 0 |
| 31 | 17/12/2012 | 9:00 | 0.10 | 0.34 | 0 |
| | | 17:00 | 0.6 | 0.30 | 0 |
| 32 | 18/12/2012 | 9:00 | 0.60 | 0.86 | 0 |
| | | 17:00 | 0.40 | 1.1 | 0 |
| 33 | 19/12/2012 | 9:00 | 0.50 | 0.90 | 0 |
| | | 17:00 | 0.181 | 0.70 | 0 |
| 34 | 20/12/2012 | 9:00 | 0.46 | 0.62 | 0 |
| | | 17:00 | 1.0 | 1.0 | 0 |
| 35 | 21/12/2012 | 9:00 | 0.88 | 0.92 | 0 |
| | | 17:00 | 0.90 | 1.0 | 0 |
| 36 | 22/12/2012 | 9:00 | 0.60 | 0.86 | 0 |
| | | 17:00 | 0.22 | 0.38 | 0 |
| 37 | 23/12/2012 | 9:00 | 0.16 | 0.32 | 0 |
| | | 17:00 | 0.4 | 0.14 | 0 |
| 38 | 24/12/2012 | 9:00 | 0.70 | 1.0 | 0 |
| | | 17:00 | 0.60 | 0.94 | 0 |
| 39 | 25/12/2012 | 9:00 | 0.50 | 0.74 | 0 |
| | | 17:00 | 0.42 | 0.52 | 0 |
| 40 | 26/12/2012 | 9:00 | 0.70 | 0.48 | 0 |
| | | 17:00 | 0.8 | 0.30 | 0 |
| 41 | 27/12/2012 | 9:00 | 0.16 | 0.42 | 0 |
| | | 17:00 | 0.20 | 0.50 | 0 |
| 42 | 28/12/2012 | 9:00 | 0.34 | 0.60 | 0 |
| | | 17:00 | 0.10 | 0.60 | 0 |
| 43 | 29/12/2012 | 9:00 | 0.64 | 0.32 | 0 |
| | | 17:00 | 0.64 | 0.32 | 0 |
| 44 | 30/12/2012 | 9:00 | 0.40 | 0.2 | 0 |
| | | 17:00 | 0.8 | 0.7 | 0 |
| 45 | 31/12/2012 | 9:00 | 0.5 | 0.3 | 0 |
| | | 17:00 | 1.5 | 1.8 | 0 |
| 46 | 1/1/2013 | 9:00 | 0.90 | 0.75 | 0 |



| | | | | | |
|----|------------|-------|------|------|------|
| | | 17:00 | 0.94 | 0.84 | 0 |
| 47 | 2/1/2013 | 9:00 | 0.80 | 0.66 | 0 |
| | | 17:00 | 0.40 | 0.34 | 0 |
| 48 | 3/1/2013 | 9:00 | 0.30 | 0.24 | 0 |
| | | 17:00 | 0.76 | 0.68 | 0 |
| 49 | 4/1/2013 | 9:00 | 0.26 | 0.20 | 0 |
| | | 17:00 | 0.76 | 0.62 | 0 |
| 50 | 5/1/2013 | 9:00 | 0.88 | 0.90 | 0 |
| | | 17:00 | 1.8 | 1.9 | 1 |
| 51 | 6/1/2013 | 9:00 | 0.86 | 0.82 | 0.2 |
| | | 17:00 | 0.70 | 0.60 | 0.15 |
| 52 | 7/1/2013 | 9:00 | 0.36 | 0.22 | 0 |
| | | 17:00 | 0.44 | 0.40 | 0 |
| 53 | 8/1/2013 | 9:00 | 0.18 | 0.14 | 0 |
| | | 17:00 | 0.13 | 0.11 | 0 |
| 54 | 9/1/2013 | 9:00 | 0.40 | 0.60 | 0 |
| | | 17:00 | 0.20 | 0.30 | 0 |
| 55 | 10/1/2013 | 9:00 | 0.18 | 0.14 | 0 |
| | | 17:00 | 0.20 | 0.22 | 0 |
| 56 | 11/1/2013 | 9:00 | 0.24 | 0.26 | 0 |
| | | 17:00 | 0.60 | 0.56 | 0 |
| 57 | 12/1/2013 | 9:00 | 0.80 | 0.84 | 0 |
| | | 17:00 | 0.94 | 0.62 | 0 |
| 58 | 13/1/2013 | 9:00 | 0.40 | 0.44 | 0 |
| | | 17:00 | 0.38 | 0.40 | 0 |
| 59 | 14/1/2013 | 9:00 | 0.30 | 0.30 | 0 |
| | | 17:00 | 0.80 | 0.84 | 0 |
| 60 | 15/1/2013 | 9:00 | 0.80 | 0.80 | 0 |
| | | 17:00 | 0.40 | 0.78 | 0 |
| 61 | 16/1/2013 | 9:00 | 0.44 | 0.76 | 0 |
| | | 17:00 | 0.46 | 0.74 | 0 |
| 62 | 17/1/2013 | 9:00 | 0.68 | 0.72 | 0 |
| | | 17:00 | 0.62 | 0.70 | 0 |
| 63 | 18/1/2013 | 9:00 | 0.60 | 0.70 | 0 |
| | | 17:00 | 0.58 | 0.68 | 0 |
| 64 | 19/1/2013 | 9:00 | 0.30 | 0.84 | 0 |
| | | 17:00 | 0.34 | 0.84 | 0 |
| 65 | 20/1/2013 | 9:00 | 0.24 | 0.86 | 0 |
| | | 17:00 | 0.18 | 0.86 | 0 |
| 66 | 21/12/2013 | 9:00 | 0.16 | 0.70 | 0 |
| | | 17:00 | 0.17 | 0.68 | 0 |



| | | | | | |
|----|-----------|-------|------|------|------|
| 67 | 22/1/2013 | 9:00 | 0.16 | 0.68 | 0 |
| | | 17:00 | 0.14 | 0.64 | 0 |
| 68 | 23/12013 | 9:00 | 0.20 | 0.60 | 0 |
| | | 17:00 | 1.7 | 1.5 | 0 |
| 69 | 24/1/2013 | 9:00 | 1.0 | 1 | 0 |
| | | 17:00 | 1.2 | 1 | 0 |
| 70 | 25/1/2013 | 9:00 | 0.12 | 0.4 | 0 |
| | | 17:00 | 0.10 | 0.6 | 0 |
| 71 | 26/1/2013 | 9:00 | 0.14 | 0.4 | 0 |
| | | 17:00 | 0.10 | 0.4 | 0 |
| 72 | 27/1/2013 | 9:00 | 0.10 | 0.8 | 0 |
| | | 17:00 | 0.10 | 0.94 | 0 |
| 73 | 28/1/2013 | 9:00 | 0.10 | 0.20 | 0 |
| | | 17:00 | 1.40 | 0.40 | 0 |
| 74 | 29/2013 | 9:00 | 1 | 0.38 | 0 |
| | | 17:00 | 1.2 | 0.34 | 1 |
| 75 | 30/1/2013 | 9:00 | 1 | 0 | 0.94 |
| | | 17:00 | 0.92 | 0.95 | 0.80 |
| 76 | 31/1/2013 | 9:00 | 0.86 | 0.88 | 0.72 |
| | | 17:00 | 0.80 | 0.82 | 0.24 |
| 77 | 1/2/2013 | 9:00 | 0.70 | 0.72 | 0 |
| | | 17:00 | 0.66 | 0.70 | 0 |
| 78 | 2/2/2013 | 9:00 | 0.90 | 0.98 | 0 |
| | | 17:00 | 0.66 | 0.7 | 0 |
| 79 | 3/2/2013 | 9:00 | 0.80 | 0.96 | 0 |
| | | 17:00 | 0.74 | 0.93 | 0 |
| 80 | 4/2/2013 | 9:00 | 0.34 | 0.86 | 0 |
| | | 17:00 | 0.30 | 0.84 | 0 |
| 81 | 5/2/2013 | 9:00 | 0.30 | 0.82 | 0 |
| | | 17:00 | 0.24 | 0.80 | 0 |
| 82 | 6/2/2013 | 9:00 | 0.22 | 0.76 | 0 |
| | | 17:00 | 0.20 | 0.72 | 0 |
| 83 | 7/2/2013 | 9:00 | 0.14 | 0.6 | 0 |
| | | 17:00 | 0.12 | 0.4 | 0 |
| 84 | 8/2/2013 | 9:00 | 0.12 | 0.4 | 0 |
| | | 17:00 | 0.10 | 0.2 | 0 |
| 85 | 9/2/2013 | 9:00 | 0.10 | 0.2 | 0 |
| | | 17:00 | 0.8 | 0.2 | 0 |
| 86 | 10/2/2013 | 9:00 | 0.8 | 0.4 | 0 |
| | | 17:00 | 0.8 | 0.6 | 0 |
| 87 | 11/2/2013 | 9:00 | 0.8 | 0.2 | 0 |



| | | | | | |
|-----|-----------|-------|------|------|---|
| | | 17:00 | 0.6 | 0.2 | 0 |
| 88 | 12/2/2013 | 9:00 | 0.14 | 0.2 | 0 |
| | | 17:00 | 0.20 | 0.30 | 0 |
| 89 | 13/2/2013 | 9:00 | 0.18 | 0.22 | 0 |
| | | 17:00 | 0.40 | 0.60 | 0 |
| 90 | 14/2/2013 | 9:00 | 0.20 | 0.2 | 0 |
| | | 17:00 | 0.22 | 0.4 | 0 |
| 91 | 15/2/2013 | 9:00 | 0.30 | 0.10 | 0 |
| | | 17:00 | 0.32 | 0.12 | 0 |
| 92 | 16/2/2013 | 9:00 | 0.30 | 0.14 | 0 |
| | | 17:00 | 0.80 | 0.60 | 0 |
| 93 | 17/2/2013 | 9:00 | 0.76 | 0.56 | 0 |
| | | 17:00 | 0.72 | 0.52 | 0 |
| 94 | 18/2/2013 | 9:00 | 0.60 | 0.40 | 0 |
| | | 17:00 | 0.90 | 0.86 | 0 |
| 95 | 19/2/2013 | 9:00 | 0.74 | 0.72 | 0 |
| | | 17:00 | 0.70 | 0.66 | 0 |
| 96 | 20/2/2013 | 9:00 | 0.60 | 0.68 | 0 |
| | | 17:00 | 0.62 | 0.50 | 0 |
| 97 | 21/2/2013 | 9:00 | 0.64 | 0.58 | 0 |
| | | 17:00 | 0.90 | 0.1 | 0 |
| 98 | 22/2/2013 | 9:00 | 0.88 | 0.90 | 0 |
| | | 17:00 | 0.60 | 0.70 | 0 |
| 99 | 23/2/2013 | 9:00 | 0.30 | 0.28 | 0 |
| | | 17:00 | 0.42 | 0.35 | 0 |
| 100 | 24/2/2013 | 9:00 | 0.40 | 0.30 | 0 |
| | | 17:00 | 0.36 | 0.22 | 0 |
| 101 | 25/2/2013 | 9:00 | 0.28 | 0.26 | 0 |
| | | 17:00 | 0.60 | 0.70 | 0 |
| 102 | 26/2/2013 | 9:00 | 0.58 | 0.68 | 0 |
| | | 17:00 | 0.52 | 0.66 | 0 |
| 103 | 27/2/2013 | 9:00 | 0.40 | 0.62 | 0 |
| | | 17:00 | 0.38 | 0.60 | 0 |
| 104 | 28/2/2013 | 9:00 | 0.10 | 0.30 | 0 |
| | | 17:00 | 0.8 | 0.30 | 0 |
| 105 | 1/3/2013 | 9:00 | 0.20 | 0.10 | 0 |
| | | 17:00 | 0.20 | 0.10 | 0 |
| 106 | 2/3/2013 | 9:00 | 0.16 | 0.10 | 0 |
| | | 17:00 | 0.14 | 0.18 | 0 |
| 107 | 3/3/2013 | 9:00 | 0.12 | 0.16 | 0 |
| | | 17:00 | 0.80 | 1 | 0 |



| | | | | | |
|-----|-----------|-------|------|------|---|
| 108 | 4/3/2013 | 9:00 | 0.58 | 0.90 | 0 |
| | | 17:00 | 0.50 | 0.70 | 0 |
| 109 | 5/3/2013 | 9:00 | 0.84 | 0.96 | 0 |
| | | 17:00 | 0.78 | 0.70 | 0 |
| 110 | 6/3/2013 | 9:00 | 0.60 | 0.70 | 0 |
| | | 17:00 | 0.56 | 0.68 | 0 |
| 111 | 7/3/2013 | 9:00 | 0.54 | 0.65 | 0 |
| | | 17:00 | 0.40 | 0.50 | 0 |
| 112 | 8/3/2013 | 9:00 | 0.42 | 0.50 | 0 |
| | | 17:00 | 1 | 1 | 0 |
| 113 | 9/3/2013 | 9:00 | 0.94 | 0.89 | 0 |
| | | 17:00 | 1 | 1 | 0 |
| 114 | 10/3/2013 | 9:00 | 0.80 | 0.82 | 0 |
| | | 17:00 | 0.90 | 0.96 | 0 |
| 115 | 11/3/2013 | 9:00 | 0.72 | 0.70 | 0 |
| | | 17:00 | 0.4 | 0.44 | 0 |
| 116 | 12/3/2013 | 9:00 | 0.65 | 0.64 | 0 |
| | | 17:00 | 0.62 | 0.6 | 0 |
| 117 | 13/3/2013 | 9:00 | 0.30 | 0.36 | 0 |
| | | 17:00 | 0.74 | 0.84 | 0 |
| 118 | 14/3/2013 | 9:00 | 0.58 | 0.62 | 0 |
| | | 17:00 | 1 | 1 | 0 |
| 119 | 15/3/2013 | 9:00 | 0.90 | 0.94 | 0 |
| | | 17:00 | 0.80 | 0.86 | 0 |
| 120 | 16/3/2013 | 9:00 | 0.62 | 0.58 | 0 |
| | | 17:00 | 0.40 | 0.4 | 0 |
| 121 | 17/3/2013 | 9:00 | 0.30 | 0.20 | 0 |
| | | 17:00 | 0.54 | 0.6 | 0 |
| 122 | 18/3/2013 | 9:00 | 0.42 | 0.68 | 0 |
| | | 17:00 | 0.30 | 0.34 | 0 |
| 123 | 19/3/2013 | 9:00 | 0.28 | 0.20 | 0 |
| | | 17:00 | 0.26 | 0.6 | 0 |
| 124 | 20/3/2013 | 9:00 | 0.24 | 0.24 | 0 |
| | | 17:00 | 0.33 | 0.36 | 0 |
| 125 | 21/3/2013 | 9:00 | 0.22 | 0.28 | 0 |
| | | 17:00 | 0.20 | 0.24 | 0 |
| 126 | 22/3/2013 | 9:00 | 0.20 | 0.22 | 0 |
| | | 17:00 | 0.18 | 0.2 | 0 |
| 127 | 23/3/2013 | 9:00 | 0.18 | 0.20 | 0 |
| | | 17:00 | 0.16 | 18 | 0 |
| 128 | 24/3/2013 | 9:00 | 0.16 | 0.18 | 0 |



| | | | | | |
|-----|-----------|-------|------|------|---|
| | | 17:00 | 0.14 | 0.14 | 0 |
| 129 | 25/3/2013 | 9:00 | 0.14 | 0.12 | 0 |
| | | 17:00 | 0.13 | 0.1 | 0 |
| 130 | 26/3/2013 | 9:00 | 0.10 | 0.80 | 0 |
| | | 17:00 | 0.30 | 0.34 | 0 |
| 131 | 27/3/2013 | 9:00 | 0.28 | 0.30 | 0 |
| | | 17:00 | 0.60 | 0.7 | 0 |
| 132 | 28/3/2013 | 9:00 | 0.58 | 0.70 | 0 |
| | | 17:00 | 0.54 | 0.66 | 0 |
| 133 | 29/3/2013 | 9:00 | 0.50 | 0.64 | 0 |
| | | 17:00 | 0.48 | 0.62 | 0 |
| 134 | 30/3/2013 | 9:00 | 0.70 | 0.74 | 0 |
| | | 17:00 | 0.6 | 0.7 | 0 |
| 135 | 31/3/2013 | 9:00 | 0.64 | 0.68 | 0 |
| | | 17:00 | 0.62 | 0.66 | 0 |
| 136 | 1/4/2013 | 9:00 | 0.30 | 0.36 | 0 |
| | | 17:00 | 0.40 | 0.5 | 0 |
| 137 | 2/4/2013 | 9:00 | 0.38 | 0.48 | 0 |
| | | 17:00 | 0.36 | 0.42 | 0 |
| 138 | 3/4/2013 | 9:00 | 0.34 | 0.4 | 0 |
| | | 17:00 | 0.56 | 0.58 | 0 |
| 139 | 4/4/2013 | 9:00 | 0.54 | 0.54 | 0 |
| | | 17:00 | 0.50 | 0.52 | 0 |
| 140 | 5/4/2013 | 9:00 | 0.48 | 0.50 | 0 |
| | | 17:00 | 0.44 | 0.46 | 0 |
| 141 | 6/4/2013 | 9:00 | 0.38 | 0.4 | 0 |
| | | 17:00 | 0.36 | 0.38 | 0 |
| 142 | 7/4/2013 | 9:00 | 0.34 | 0.36 | 0 |
| | | 17:00 | 0.30 | 0.32 | 0 |
| 143 | 8/4/2013 | 9:00 | 0.70 | 0.72 | 0 |
| | | 17:00 | 0.68 | 0.70 | 0 |
| 144 | 10/4/2013 | 9:00 | 0.30 | 0.40 | 0 |
| | | 17:00 | 0.30 | 0.38 | 0 |
| 145 | 11/4/2013 | 9:00 | 0.32 | 0.34 | 0 |
| | | 17:00 | 0.30 | 0.32 | 0 |
| 146 | 12/4/2013 | 9:00 | 0.20 | 0.24 | 0 |
| | | 17:00 | 0.18 | 0.22 | 0 |
| 147 | 13/4/2013 | 9:00 | 0.18 | 0.20 | 0 |
| | | 17:00 | 0.16 | 0.20 | 0 |
| 148 | 14/4/2013 | 9:00 | 0.14 | 0.18 | 0 |
| | | 17:00 | 0.12 | 0.16 | 0 |



| | | | | | |
|-----|-----------|-------|------|------|---|
| 149 | 15/4/2013 | 9:00 | 0.10 | 0.14 | 0 |
| | | 17:00 | 0.8 | 0.12 | 0 |
| 150 | 16/4/2013 | 9:00 | 0.8 | 0.10 | 0 |
| | | 17:00 | 0.6 | 0.18 | 0 |
| 151 | 17/4/2013 | 9:00 | 0.6 | 0.8 | 0 |
| | | 17:00 | 0.6 | 0.8 | 0 |
| 152 | 18/4/2013 | 9:00 | 0.6 | 0.8 | 0 |
| | | 17:00 | 0.4 | 0.8 | 0 |
| 153 | 19/4/2013 | 9:00 | 0.4 | 0.6 | 0 |
| | | 17:00 | 0.4 | 0.6 | 0 |
| 154 | 20/4/2013 | 9:00 | 0.2 | 0.4 | 0 |
| | | 17:00 | 0.2 | 0.4 | 0 |
| 155 | 21/4/2013 | 9:00 | 0 | 0.4 | 0 |
| | | 17:00 | 0 | 0.2 | 0 |
| 156 | 22/4/2013 | 9:00 | 0 | 0.2 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 157 | 23/4/2013 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 158 | 24/4/2013 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 159 | 25/4/2013 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 160 | 26/4/2013 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 161 | 27/4/2013 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 162 | 28/4/2013 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 163 | 29/4/2013 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 164 | 30/4/2013 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 165 | 1/5/2013 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 166 | 2/5/2013 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 167 | 3/5/2013 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 168 | 4/5/2013 | 9:00 | 0 | 0 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 169 | 5/5/2013 | 9:00 | 0 | 0 | 0 |



| | | | | | |
|-----|-----------|-------|------|------|---|
| | | 17:00 | 0 | 0 | 0 |
| 170 | 6/5/2013 | 9:00 | 0.30 | 0 | 0 |
| | | 17:00 | 0.30 | 0.36 | 0 |
| 171 | 7/5/2013 | 9:00 | 0.20 | 0.30 | 0 |
| | | 17:00 | 0.15 | 0.26 | 0 |
| 172 | 8/5/2013 | 9:00 | 0.10 | 0.2 | 0 |
| | | 17:00 | 0 | 0 | 0 |
| 173 | 9/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 174 | 10/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 175 | 11/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 176 | 12/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 177 | 13/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 178 | 14/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 179 | 15/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 180 | 16/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 181 | 17/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 182 | 18/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 183 | 19/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 184 | 20/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 185 | 21/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 186 | 22/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 187 | 23/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 188 | 24/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 189 | 25/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |



| | | | | | |
|-----|------------|-------|------|------|---|
| 190 | 26/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 200 | 27/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 201 | 28/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 202 | 29/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 203 | 30/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 204 | 31/5/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 205 | 1/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 206 | 2/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 207 | 3/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 208 | 4/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 209 | 5/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 210 | 6/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 211 | 7/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.30 | 34 | 0 |
| 212 | 8/6/2013 | 9:00 | 0.30 | 0.36 | 0 |
| | | 17:00 | 0.40 | 0.40 | 0 |
| 213 | 9/6/2013 | 9:00 | 0.30 | 0.38 | 0 |
| | | 17:00 | 0.28 | 0.3 | 0 |
| 214 | 10/6/2013 | 9:00 | 0.20 | 0.22 | 0 |
| | | 17:00 | 0.16 | 0.18 | 0 |
| 215 | 11/6/2013 | 9:00 | 0.10 | 0.14 | 0 |
| | | 17:00 | 0.80 | 0.10 | 0 |
| 216 | 12//6/2013 | 9:00 | 0.4 | 0.6 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 217 | 13/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 218 | 14/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 219 | 15/6/2013 | 9:00 | 0.00 | 0 | 0 |



| | | | | | |
|-----|------------|-------|------|---|---|
| | | 17:00 | 0.00 | 0 | 0 |
| 220 | 16/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 221 | 17/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 222 | 18/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 223 | 19/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 224 | 20/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 225 | 21/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 226 | 22//6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 227 | 23/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 228 | 24/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 229 | 25/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 230 | 26/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 231 | 27/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 232 | 28/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 234 | 29/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |
| 235 | 30/6/2013 | 9:00 | 0.00 | 0 | 0 |
| | | 17:00 | 0.00 | 0 | 0 |

The arithmetic average of the stage height was calculated by adding the zero value of water depth, which was presented from the previous table. Stage height of the station #1 will be adjusted by 0.4 m and station #2 by 0.35 meter. The absolute value of stage-height which will be used in the calculated of discharge are presented in the following table.



Table 3 The Adjusted Hydrological Data Using Baseline Data and average height

| MM-YY | DD | S1, m | S2, m | S3, m |
|--------|----|-------|-------|-------|
| Nov-12 | 17 | 0.4 | 0.35 | 0.55 |
| Nov-12 | 18 | 0.4 | 0.35 | 0.55 |
| Nov-12 | 19 | 0.4 | 0.35 | 0.55 |
| Nov-12 | 20 | 0.4 | 0.35 | 0.55 |
| Nov-12 | 21 | 0.4 | 0.35 | 0.55 |
| Nov-12 | 22 | 0.4 | 0.35 | 0.55 |
| Nov-12 | 23 | 0.4 | 0.35 | 0.55 |
| Nov-12 | 24 | 0.4 | 0.35 | 0.55 |
| Nov-12 | 25 | 0.41 | 0.55 | 0.55 |
| Nov-12 | 26 | 0.4 | 0.35 | 0.55 |
| Nov-12 | 27 | 0.4 | 0.35 | 0.55 |
| Nov-12 | 28 | 0.4 | 0.35 | 0.55 |
| Nov-12 | 29 | 0.6 | 1.15 | 0.55 |
| Nov-12 | 30 | 0.4 | 0.87 | 0.55 |
| Dec-12 | 1 | 0.4 | 0.71 | 0.55 |
| Dec-12 | 2 | 0.6 | 0.4 | 0.55 |
| Dec-12 | 3 | 0.4 | 0.35 | 0.55 |
| Dec-12 | 4 | 0.4 | 0.35 | 0.55 |
| Dec-12 | 5 | 0.4 | 0.35 | 0.55 |
| Dec-12 | 6 | 0.4 | 0.35 | 0.55 |
| Dec-12 | 7 | 0.45 | 0.7 | 0.55 |



| | | | | |
|--------|----|--------|-------|------|
| Dec-12 | 8 | 0.4 | 0.55 | 0.55 |
| Dec-12 | 9 | 0.4 | 0.35 | 0.55 |
| Dec-12 | 10 | 0.4 | 0.75 | 0.55 |
| Dec-12 | 11 | 0.5 | 0.49 | 0.55 |
| Dec-12 | 12 | 0.7 | 0.48 | 0.55 |
| Dec-12 | 13 | 0.55 | 0.49 | 0.55 |
| Dec-12 | 14 | 0.5 | 0.8 | 0.55 |
| Dec-12 | 15 | 0.8 | 1.05 | 0.55 |
| Dec-12 | 16 | 1 | 0.85 | 0.55 |
| Dec-12 | 17 | 0.75 | 0.67 | 0.55 |
| Dec-12 | 18 | 0.9 | 1.33 | 0.55 |
| Dec-12 | 19 | 0.7405 | 1.15 | 0.55 |
| Dec-12 | 20 | 1.13 | 1.16 | 0.55 |
| Dec-12 | 21 | 1.29 | 1.31 | 0.55 |
| Dec-12 | 22 | 0.81 | 0.97 | 0.55 |
| Dec-12 | 23 | 0.68 | 0.58 | 0.55 |
| Dec-12 | 24 | 1.05 | 1.32 | 0.55 |
| Dec-12 | 25 | 0.86 | 0.98 | 0.55 |
| Dec-12 | 26 | 1.15 | 0.74 | 0.55 |
| Dec-12 | 27 | 0.58 | 0.81 | 0.55 |
| Dec-12 | 28 | 0.62 | 0.95 | 0.55 |
| Dec-12 | 29 | 1.04 | 0.67 | 0.55 |
| Dec-12 | 30 | 1 | 0.8 | 0.55 |
| Dec-12 | 31 | 1.4 | 1.4 | 0.55 |
| Jan-13 | 1 | 1.32 | 1.145 | 0.55 |



| | | | | |
|--------|----|-------|-------|-------|
| Jan-13 | 2 | 1 | 0.85 | 0.55 |
| Jan-13 | 3 | 0.93 | 0.81 | 0.55 |
| Jan-13 | 4 | 0.91 | 0.76 | 0.55 |
| Jan-13 | 5 | 1.74 | 1.75 | 1.05 |
| Jan-13 | 6 | 1.18 | 1.06 | 0.725 |
| Jan-13 | 7 | 0.8 | 0.66 | 0.55 |
| Jan-13 | 8 | 0.555 | 0.475 | 0.55 |
| Jan-13 | 9 | 0.7 | 0.8 | 0.55 |
| Jan-13 | 10 | 0.59 | 0.53 | 0.55 |
| Jan-13 | 11 | 0.82 | 0.76 | 0.55 |
| Jan-13 | 12 | 1.27 | 1.08 | 0.55 |
| Jan-13 | 13 | 0.79 | 0.77 | 0.55 |
| Jan-13 | 14 | 0.95 | 0.92 | 0.55 |
| Jan-13 | 15 | 1 | 1.14 | 0.55 |
| Jan-13 | 16 | 0.85 | 1.1 | 0.55 |
| Jan-13 | 17 | 1.05 | 1.06 | 0.55 |
| Jan-13 | 18 | 0.99 | 1.04 | 0.55 |
| Jan-13 | 19 | 0.72 | 1.19 | 0.55 |
| Jan-13 | 20 | 0.61 | 1.21 | 0.55 |
| Jan-13 | 21 | 0.565 | 1.04 | 0.55 |
| Jan-13 | 22 | 0.55 | 1.01 | 0.55 |
| Jan-13 | 23 | 1.35 | 1.4 | 0.55 |
| Jan-13 | 24 | 1.5 | 1.35 | 0.55 |
| Jan-13 | 25 | 0.51 | 0.85 | 0.55 |
| Jan-13 | 26 | 0.52 | 0.75 | 0.55 |



| | | | | |
|--------|----|------|-------|------|
| Jan-13 | 27 | 0.5 | 1.22 | 0.55 |
| Jan-13 | 28 | 1.15 | 0.65 | 0.55 |
| Jan-13 | 29 | 1.5 | 0.71 | 1.05 |
| Jan-13 | 30 | 1.36 | 0.825 | 1.42 |
| Jan-13 | 31 | 1.23 | 1.2 | 1.03 |
| Feb-13 | 1 | 1.08 | 1.06 | 0.55 |
| Feb-13 | 2 | 1.18 | 1.19 | 0.55 |
| Feb-13 | 3 | 1.17 | 1.295 | 0.55 |
| Feb-13 | 4 | 0.72 | 1.2 | 0.55 |
| Feb-13 | 5 | 0.67 | 1.16 | 0.55 |
| Feb-13 | 6 | 0.61 | 1.09 | 0.55 |
| Feb-13 | 7 | 0.53 | 0.85 | 0.55 |
| Feb-13 | 8 | 0.51 | 0.65 | 0.55 |
| Feb-13 | 9 | 0.85 | 0.55 | 0.55 |
| Feb-13 | 10 | 1.2 | 0.85 | 0.55 |
| Feb-13 | 11 | 1.1 | 0.55 | 0.55 |
| Feb-13 | 12 | 0.57 | 0.6 | 0.55 |
| Feb-13 | 13 | 0.69 | 0.76 | 0.55 |
| Feb-13 | 14 | 0.61 | 0.65 | 0.55 |
| Feb-13 | 15 | 0.71 | 0.46 | 0.55 |
| Feb-13 | 16 | 0.95 | 0.72 | 0.55 |
| Feb-13 | 17 | 1.14 | 0.89 | 0.55 |
| Feb-13 | 18 | 1.15 | 0.98 | 0.55 |
| Feb-13 | 19 | 1.12 | 1.04 | 0.55 |
| Feb-13 | 20 | 1.01 | 0.94 | 0.55 |



| | | | | |
|--------|----|-------|-------|------|
| Feb-13 | 21 | 1.17 | 0.69 | 0.55 |
| Feb-13 | 22 | 1.14 | 1.15 | 0.55 |
| Feb-13 | 23 | 0.76 | 0.665 | 0.55 |
| Feb-13 | 24 | 0.78 | 0.61 | 0.55 |
| Feb-13 | 25 | 0.84 | 0.83 | 0.55 |
| Feb-13 | 26 | 0.95 | 1.02 | 0.55 |
| Feb-13 | 27 | 0.79 | 0.96 | 0.55 |
| Feb-13 | 28 | 0.85 | 0.65 | 0.55 |
| Mar-13 | 1 | 0.6 | 0.45 | 0.55 |
| Mar-13 | 2 | 0.55 | 0.49 | 0.55 |
| Mar-13 | 3 | 0.86 | 0.93 | 0.55 |
| Mar-13 | 4 | 0.94 | 1.15 | 0.55 |
| Mar-13 | 5 | 1.21 | 1.18 | 0.55 |
| Mar-13 | 6 | 0.98 | 1.04 | 0.55 |
| Mar-13 | 7 | 0.87 | 0.925 | 0.55 |
| Mar-13 | 8 | 1.11 | 1.1 | 0.55 |
| Mar-13 | 9 | 1.37 | 1.295 | 0.55 |
| Mar-13 | 10 | 1.25 | 1.24 | 0.55 |
| Mar-13 | 11 | 0.96 | 0.92 | 0.55 |
| Mar-13 | 12 | 1.035 | 0.97 | 0.55 |
| Mar-13 | 13 | 0.92 | 0.95 | 0.55 |
| Mar-13 | 14 | 1.19 | 1.16 | 0.55 |
| Mar-13 | 15 | 1.25 | 1.25 | 0.55 |
| Mar-13 | 16 | 0.91 | 0.84 | 0.55 |
| Mar-13 | 17 | 0.82 | 0.75 | 0.55 |



| | | | | |
|--------|----|-------|------|------|
| Mar-13 | 18 | 0.76 | 0.86 | 0.55 |
| Mar-13 | 19 | 0.67 | 0.75 | 0.55 |
| Mar-13 | 20 | 0.685 | 0.65 | 0.55 |
| Mar-13 | 21 | 0.61 | 0.61 | 0.55 |
| Mar-13 | 22 | 0.59 | 0.56 | 0.55 |
| Mar-13 | 23 | 0.57 | 0.54 | 0.55 |
| Mar-13 | 24 | 0.55 | 0.51 | 0.55 |
| Mar-13 | 25 | 0.535 | 0.46 | 0.55 |
| Mar-13 | 26 | 0.6 | 0.92 | 0.55 |
| Mar-13 | 27 | 0.84 | 0.85 | 0.55 |
| Mar-13 | 28 | 0.96 | 1.03 | 0.55 |
| Mar-13 | 29 | 0.89 | 0.98 | 0.55 |
| Mar-13 | 30 | 1.05 | 1.07 | 0.55 |
| Mar-13 | 31 | 1.03 | 1.02 | 0.55 |
| Apr-13 | 1 | 0.75 | 0.78 | 0.55 |
| Apr-13 | 2 | 0.77 | 0.8 | 0.55 |
| Apr-13 | 3 | 0.85 | 0.84 | 0.55 |
| Apr-13 | 4 | 0.92 | 0.88 | 0.55 |
| Apr-13 | 5 | 0.86 | 0.83 | 0.55 |
| Apr-13 | 6 | 0.77 | 0.74 | 0.55 |
| Apr-13 | 7 | 0.72 | 0.69 | 0.55 |
| Apr-13 | 8 | 1.09 | 1.06 | 0.55 |
| Apr-13 | 9 | 1 | 1.03 | 0.55 |
| Apr-13 | 10 | 0.7 | 0.74 | 0.55 |
| Apr-13 | 11 | 0.71 | 0.68 | 0.55 |



| | | | | |
|--------|----|------|------|------|
| Apr-13 | 12 | 0.59 | 0.58 | 0.55 |
| Apr-13 | 13 | 0.57 | 0.55 | 0.55 |
| Apr-13 | 14 | 0.53 | 0.52 | 0.55 |
| Apr-13 | 15 | 0.85 | 0.48 | 0.55 |
| Apr-13 | 16 | 1.1 | 0.49 | 0.55 |
| Apr-13 | 17 | 1 | 1.15 | 0.55 |
| Apr-13 | 18 | 0.9 | 1.15 | 0.55 |
| Apr-13 | 19 | 0.8 | 0.95 | 0.55 |
| Apr-13 | 20 | 0.6 | 0.75 | 0.55 |
| Apr-13 | 21 | 0.4 | 0.65 | 0.55 |
| Apr-13 | 22 | 0.4 | 0.35 | 0.55 |
| Apr-13 | 23 | 0.4 | 0.35 | 0.55 |
| Apr-13 | 24 | 0.4 | 0.35 | 0.55 |
| Apr-13 | 25 | 0.4 | 0.35 | 0.55 |
| Apr-13 | 26 | 0.4 | 0.35 | 0.55 |
| Apr-13 | 27 | 0.4 | 0.35 | 0.55 |
| Apr-13 | 28 | 0.4 | 0.35 | 0.55 |
| Apr-13 | 29 | 0.4 | 0.35 | 0.55 |
| Apr-13 | 30 | 0.4 | 0.35 | 0.55 |
| May-13 | 1 | 0.4 | 0.35 | 0.55 |
| May-13 | 2 | 0.4 | 0.35 | 0.55 |
| May-13 | 3 | 0.4 | 0.35 | 0.55 |
| May-13 | 4 | 0.4 | 0.35 | 0.55 |
| May-13 | 5 | 0.4 | 0.35 | 0.55 |
| May-13 | 6 | 0.7 | 0.53 | 0.55 |



| | | | | |
|--------|----|-------|------|------|
| May-13 | 7 | 0.575 | 0.63 | 0.55 |
| May-13 | 8 | 0.45 | 0.45 | 0.55 |
| May-13 | 9 | 0.4 | 0.35 | 0.55 |
| May-13 | 10 | 0.4 | 0.35 | 0.55 |
| May-13 | 11 | 0.4 | 0.35 | 0.55 |
| May-13 | 12 | 0.4 | 0.35 | 0.55 |
| May-13 | 13 | 0.4 | 0.35 | 0.55 |
| May-13 | 14 | 0.4 | 0.35 | 0.55 |
| May-13 | 15 | 0.4 | 0.35 | 0.55 |
| May-13 | 16 | 0.4 | 0.35 | 0.55 |
| May-13 | 17 | 0.4 | 0.35 | 0.55 |
| May-13 | 18 | 0.4 | 0.35 | 0.55 |
| May-13 | 19 | 0.4 | 0.35 | 0.55 |
| May-13 | 20 | 0.4 | 0.35 | 0.55 |
| May-13 | 21 | 0.4 | 0.35 | 0.55 |
| May-13 | 22 | 0.4 | 0.35 | 0.55 |
| May-13 | 23 | 0.4 | 0.35 | 0.55 |
| May-13 | 24 | 0.4 | 0.35 | 0.55 |
| May-13 | 25 | 0.4 | 0.35 | 0.55 |
| May-13 | 26 | 0.4 | 0.35 | 0.55 |
| May-13 | 27 | 0.4 | 0.35 | 0.55 |
| May-13 | 28 | 0.4 | 0.35 | 0.55 |
| May-13 | 29 | 0.4 | 0.35 | 0.55 |
| May-13 | 30 | 0.4 | 0.35 | 0.55 |
| May-13 | 31 | 0.4 | 0.35 | 0.55 |



| | | | | |
|--------|----|------|------|------|
| Jun-13 | 1 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 2 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 3 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 4 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 5 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 6 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 7 | 0.55 | 0.53 | 0.55 |
| Jun-13 | 8 | 0.75 | 0.73 | 0.55 |
| Jun-13 | 9 | 0.69 | 0.69 | 0.55 |
| Jun-13 | 10 | 0.58 | 0.55 | 0.55 |
| Jun-13 | 11 | 0.85 | 0.47 | 0.55 |
| Jun-13 | 12 | 0.6 | 0.65 | 0.55 |
| Jun-13 | 13 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 14 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 15 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 16 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 17 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 18 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 19 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 20 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 21 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 22 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 23 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 24 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 25 | 0.4 | 0.35 | 0.55 |



| | | | | |
|--------|----|-----|------|------|
| Jun-13 | 26 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 27 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 28 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 29 | 0.4 | 0.35 | 0.55 |
| Jun-13 | 30 | 0.4 | 0.35 | 0.55 |

This data will be used in the calculation of average daily discharge in each station.

3.4 Bi-Monthly Observation

Current of the stream was measured on semi-monthly basis (twice a month) for the period of the project (November 2012 to June 2013). Measurement will be conducted for two different conditions of water depth – when depth of water is less than 0.75 meter and when depth of water is greater than 0.75 meter. When water depth is less than 0.75 meter, measurement will be conducted at 60% depth from the surface whereas when water depth is greater than 0.75 meter, measurement will be taken at two points in vertical direction – at 20% and 80% depths from the surface. The data of the average value of water depth, velocity, width, flow area, and respective discharges are presented in the following table (Table 4 & Table 5).

Table 4: Semi-monthly Discharge Observation (For various water depth) at Station #1

| DD/ MM/ YYYY | Water level, m | Velocity m/s | Width, m | Area, m ² | Discharge, m ³ /s |
|---------------------|----------------|--------------|----------|----------------------|------------------------------|
| | S1 | S1 | S1 | S1 | S1 |
| 17/ 11/ 2012 | 0.10 | 0.20 | 2.00 | 0.20 | 0.04 |
| 29/ 11/ 2012 | 0.10 | 0.24 | 2.00 | 0.20 | 0.05 |
| 08/ 12/ 12 | 0.20 | 0.30 | 0.50 | 0.10 | 0.03 |
| 27/ 12/ 2012 | 0.36 | 0.98 | 18.60 | 6.70 | 6.56 |
| 29/ 12/ 2012 | 0.37 | 1.15 | 27.20 | 10.06 | 11.57 |
| 11/ 1/ 2013 : 14:00 | 1.00 | 1.20 | 29.50 | 29.50 | 35.40 |
| 11/ 1/ 2013: 15:00 | 1.20 | 1.50 | 29.50 | 35.40 | 53.10 |
| 15/ 1/ 2013 | 1.3 | 1.4 | 44.2 | 57.46 | 80.44 |
| 30/ 1/ 2013 | 0.4 | 1.013 | 13 | 5.20 | 5.27 |
| 12/ 02/ 12 | 0.33 | 0.1 | 13 | 4.29 | 0.43 |
| 27/ 2/ 2012 | 0.15 | 0.49 | 13 | 1.95 | 0.96 |
| 11/ 03/ 13 | 0.8 | 1.5 | 13 | 10.40 | 15.60 |
| 27/ 3/ 2013 | 0.3 | 0.53 | 10 | 3.00 | 1.59 |
| 12/ 4/ 2013 | 0.35 | 1.1 | 28.6 | 10.01 | 11.01 |



| | | | | | |
|-------------|------|------|------|------|------|
| 26/ 4/ 2013 | 0.25 | 0.6 | 28.6 | 7.15 | 4.29 |
| 12/ 5/ 2013 | 0.2 | 0.8 | 28.6 | 5.72 | 4.58 |
| 26/ 5/ 2013 | 0.25 | 0.45 | 28.6 | 7.15 | 3.22 |
| 12/ 6/ 2013 | 0.23 | 0.4 | 28.6 | 6.58 | 2.63 |
| 26/ 6/ 2013 | 0.23 | 0.4 | 28.6 | 6.58 | 2.63 |

Table Semi-monthly Discharge Observation (For various water depth) at Station #2

| DD/ MM/ YYYY | Water level | Velocity | Width | Area | Discharge |
|---------------------|-------------|----------|-------|----------------|--------------------|
| | m | m/ s | m | m ² | m ³ / s |
| | S2 | S2 | S2 | S2 | S2 |
| 17/ 11/ 2012 | 0.38 | 0.50 | 9.30 | 3.53 | 1.76 |
| 29/ 11/ 2012 | 0.33 | 0.38 | 9.30 | 3.07 | 1.18 |
| 08/ 12/ 12 | 0.41 | 0.60 | 9.50 | 3.90 | 2.34 |
| 27/ 12/ 2012 | 0.45 | 0.10 | 4.00 | 1.80 | 0.18 |
| 29/ 12/ 2012 | 0.50 | 0.22 | 6.00 | 3.00 | 0.66 |
| 11/ 1/ 2013 - 14:00 | 0.70 | 1.40 | 9.00 | 6.30 | 8.82 |
| 11/ 1/ 2013 - 15:00 | 1.20 | 1.50 | 9.00 | 10.80 | 16.20 |
| 15/ 1/ 2013 | 1.6 | 1.35 | 15.6 | 24.96 | 33.70 |
| 30/ 1/ 2013 | 0.4 | 1.24 | 51.8 | 20.72 | 25.69 |
| 12/ 02/ 12 | 0.255 | 0.95 | 49.8 | 12.70 | 12.06 |
| 27/ 2/ 2012 | 0.33 | 0.83 | 69.4 | 22.90 | 19.01 |
| 11/ 03/ 13 | 0.4 | 0.977 | 46.8 | 18.72 | 18.29 |
| 27/ 3/ 2013 | 0.34 | 0.91 | 46.8 | 15.91 | 14.48 |
| 12/ 4/ 2013 | 1.2 | 1.1 | 31.36 | 37.63 | 41.40 |
| 26/ 4/ 2013 | 0.6 | 0.84 | 31.2 | 18.72 | 15.72 |
| 12/ 5/ 2013 | 0.45 | 0.75 | 31.2 | 14.04 | 10.53 |
| 26/ 5/ 2013 | 0.4 | 0.67 | 31.2 | 12.48 | 8.36 |
| 12/ 6/ 2013 | 0.35 | 0.5 | 31.2 | 10.92 | 5.46 |
| 26/ 6/ 2013 | 0.35 | 0.5 | 31.2 | 10.92 | 5.46 |



Table Semi-monthly Discharge Observation (For various water depths) at Station #3

| DD/ MM/ YYYY | Water level, | Velocity | Width | Area | Discharge, m ³ /s |
|---------------------|--------------|----------|-------|----------------|---------------------------------|
| | m | m/s | m | m ² | |
| | S3 | S3 | S3 | S3 | |
| 17/ 11/ 2012 | 0 | 0 | 0 | 0 | 0 |
| 29/ 11/ 2012 | 0 | 0 | 0 | 0 | 0 |
| 8/ 12/ 2012 | 0 | 0 | 0 | 0 | 0 |
| 27/ 12/ 2012 | 0 | 0 | 0 | 0 | 0 |
| 29/ 12/ 2012 | 0 | 0 | 0 | 0 | 0 |
| 11/ 1/ 2013 : 14:00 | 0 | 0 | 0 | 0 | 0 |
| 11/ 1/ 2013: 15:00 | 0 | 0 | 0 | 0 | 0 |
| 15/ 1/ 2013 | 0 | 0 | 0 | 0 | 0 |
| 30/ 1/ 2013 | 0 | 0 | 0 | 0 | 0 |
| 12/ 2/ 2012 | 0 | 0 | 0 | 0 | 0 |
| 27/ 2/ 2012 | 0 | 0 | 0 | 0 | 0 |
| 11/ 3/ 2013 | 0 | 0 | 0 | 0 | 0 |
| 27/ 3/ 2013 | 0 | 0 | 0 | 0 | 0 |
| 12/ 4/ 2013 | 0 | 0 | 0 | 0 | 0 |
| 26/ 4/ 2013 | 0 | 0 | 0 | 0 | 0 |
| 12/ 5/ 2013 | 0 | 0 | 0 | 0 | 0 |
| 26/ 5/ 2013 | 0 | 0 | 0 | 0 | 0 |
| 12/ 6/ 2013 | 0 | 0 | 0 | 0 | 0 |
| 26/ 6/ 2013 | 0 | 0 | 0 | 0 | 0 |

S = Station; N = Number of Station

The H and Q from the above table will be used to derive the relationship between the H and Q for the estimation of daily discharge.

Note that no water was flowed through the station #3 and therefore no data was taken from this site.

3.5 High Flow Observation

High flow observation is necessary to collect data for the development of stage-discharge relations. Communication between the local staff and PEC-Consulting will be established to provide necessary information on the likelihood of high intensity rain event that will potentially produce high flow condition. Based on information from local staff and ground



Table 5: High Flow Observation during the Survey Time Frame

| DD/MM/YYYY | Water level, m | | | Discharge, m ³ /s | | | Total Flow |
|------------------|----------------|------|----|------------------------------|-------|----|------------|
| | S1 | S2 | S3 | S1 | S2 | S3 | |
| 11/1/2013: 14:00 | 1 | 0.7 | 0 | 35.4 | 8.82 | 0 | 44.22 |
| 11/1/2013: 15:00 | 1.2 | 1.2 | 0 | 53.1 | 16.2 | 0 | 69.3 |
| 15/1/2013 | 1.3 | 1.6 | 0 | 99.01 | 33.70 | 0 | 132.7 |
| 26/2/2012 | 0.15 | 0.33 | 0 | 0.96 | 19.01 | 0 | 19.96 |
| 12/3/2013 | 1.3 | 0.35 | 0 | 25.35 | 15.44 | 0 | 40.79 |
| 26/3/2013 | 0.35 | 0.36 | 0 | 1.855 | 15.35 | 0 | 17.21 |
| 11/4/2013 | 0.45 | 0.4 | 0 | 2.93 | 16.02 | 0 | 18.94 |
| 27/4/2013 | 0.42 | 1.24 | 0 | 13.93 | 46.66 | 0 | 60.6 |
| 5/5/2013 | 0.28 | 0.52 | 0 | 7.61 | 13.79 | 0 | 21.4 |
| 24/5/2013 | 0.3 | 0.45 | 0 | 4.72 | 10.53 | 0 | 15.25 |
| 8/6/2013 | 0.25 | 0.43 | 0 | 3.72 | 8.72 | 0 | 12.44 |

Similar darification could be drawn which is to point out that the no flow was observed in the station #3.

3.6 Scatter Plot of H-Q relation

The relationship between the height and discharge were plot in the following figures, which shows the trend of the polynomial equation to be derived.

Table 6 Average height and Discharge at Station #1

| DD/ MM/ YYYY | Water level, m S1 | Discharge, m ³ /s S1 |
|---------------------|----------------------|------------------------------------|
| 17/ 11/ 2012 | 0.10 | 0.04 |
| 29/ 11/ 2012 | 0.10 | 0.05 |
| 08/ 12/ 12 | 0.20 | 0.03 |
| 27/ 12/ 2012 | 0.36 | 6.56 |
| 29/ 12/ 2012 | 0.37 | 11.57 |
| 11/ 1/ 2013 : 14:00 | 1.00 | 35.40 |
| 11/ 1/ 2013: 15:00 | 1.20 | 53.10 |
| 15/ 1/ 2013 | 1.3 | 80.44 |
| 30/ 1/ 2013 | 0.4 | 5.27 |
| 12/ 02/ 12 | 0.33 | 0.43 |
| 27/ 2/ 2012 | 0.15 | 0.96 |
| 12/ 03/ 13 | 0.8 | 15.60 |
| 26/ 3/ 2013 | 0.3 | 1.59 |



| | | |
|-------------|------|-------|
| 12/ 4/ 2013 | 0.35 | 11.01 |
| 26/ 4/ 2013 | 0.25 | 4.29 |
| 12/ 5/ 2013 | 0.2 | 4.58 |
| 26/ 5/ 2013 | 0.25 | 3.22 |
| 12/ 6/ 2013 | 0.23 | 2.63 |
| 26/ 6/ 2013 | 0.23 | 2.63 |

Figure 10 Polinomial Equation of stage-discharge relation

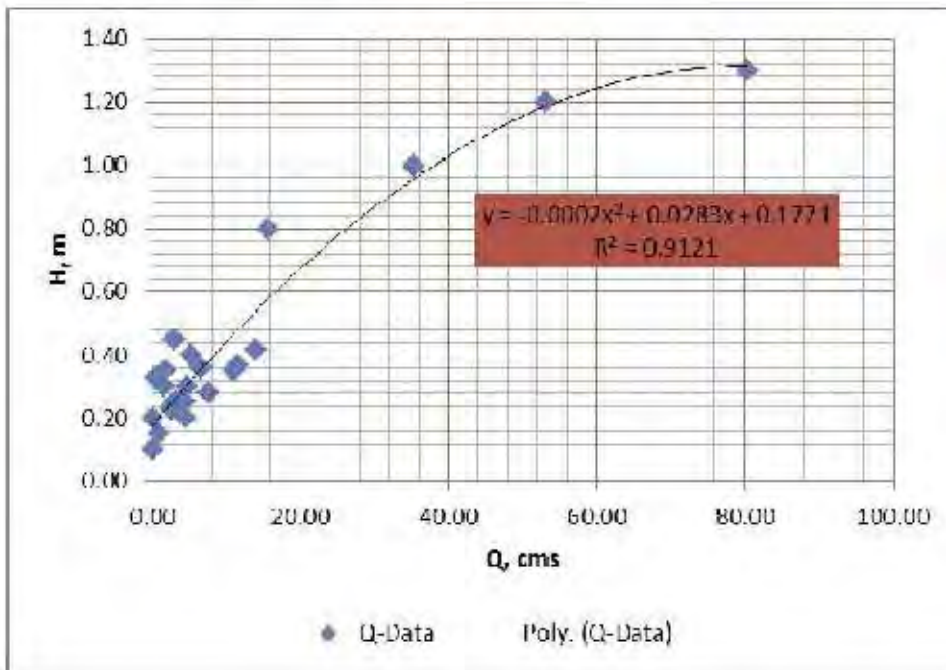
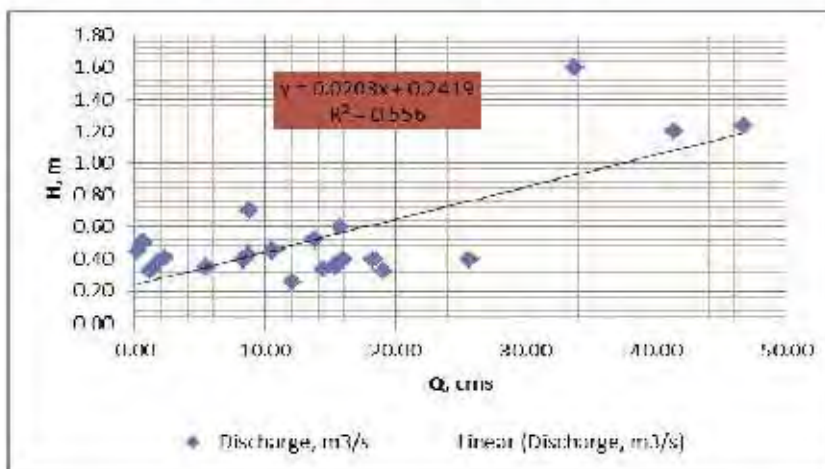




Table 7 Average height and Discharge at Station #2

| DD/ MM/ YYYY | Water level, m | Discharge, m ³ / s |
|---------------------|----------------|-------------------------------|
| | S2 | S2 |
| 17/ 11/ 2012 | 0.38 | 1.76 |
| 29/ 11/ 2012 | 0.33 | 1.18 |
| 08/ 12/ 12 | 0.41 | 2.34 |
| 27/ 12/ 2012 | 0.45 | 0.18 |
| 29/ 12/ 2012 | 0.50 | 0.66 |
| 11/ 1/ 2013 : 14:00 | 0.70 | 8.82 |
| 11/ 1/ 2013: 15:00 | 1.20 | 16.20 |
| 15/ 1/ 2013 | 1.60 | 33.70 |
| 30/ 1/ 2013 | 0.40 | 25.69 |
| 12/ 02/ 12 | 0.26 | 12.06 |
| 27/ 2/ 2012 | 0.33 | 19.01 |
| 12/ 03/ 13 | 0.40 | 18.29 |
| 26/ 3/ 2013 | 0.34 | 14.48 |
| 12/ 4/ 2013 | 1.20 | 41.40 |
| 26/ 4/ 2013 | 0.60 | 15.72 |
| 12/ 5/ 2013 | 0.45 | 10.53 |
| 26/ 5/ 2013 | 0.40 | 8.36 |
| 12/ 6/ 2013 | 0.35 | 5.46 |
| 26/ 6/ 2013 | 0.35 | 5.46 |

Figure 11: Stage-Discharge relation at Station #2





The rating curve for station #3 can not be derived as the data is not available and this limitation will affect the usage of rating curve for the prediction of discharge from the measured height.

4. Stage-Discharge and Discharge Calculation

4.1 Rating Curve (H versus Q)

The polynomial equal of discharge versus stage for station #1 can be represented by the following power function.

$$H = -2 \times 10^{-5} Q^2 + 0.0283Q - 0.1771$$

With $R^2 = 0.91$

While the equation for station #2 is not promising as the trend approach to linear equation.

$$H = 0.0203Q - 0.242$$

With $R^2 = 0.56$

These two equations were used to calculate the average daily discharge of Laleia River from the average daily water height, which was observed daily.

4.3 Daily Discharge Calculation

The above curve of discharge relation to the height will be used to calculate the daily discharge from the daily height observation. The daily discharge from period of November 2012 to June 2013 can be seen from the following table.

Table 8 Daily average flow of Laleia River from Period of November 2012 to June 2013

| M-Year | DD | H1, m | H2, m | H3, m | Q1, cms | Q2, cms | Total Flow, cms |
|--------|----|-------|-------|-------|---------|---------|-----------------|
| Nov-12 | 1 | | | | - | - | - |
| Nov-12 | 2 | | | | - | - | - |
| Nov-12 | 3 | | | | - | - | - |
| Nov-12 | 4 | | | | - | - | - |
| Nov-12 | 5 | | | | - | - | - |
| Nov-12 | 6 | | | | - | - | - |



| | | | | | | | |
|--------|----|------|------|------|-------|-------|-------|
| Nov-12 | 7 | | | | - | - | - |
| Nov-12 | 8 | | | | - | - | - |
| Nov-12 | 9 | | | | - | - | - |
| Nov-12 | 10 | | | | - | - | - |
| Nov-12 | 11 | | | | - | - | - |
| Nov-12 | 12 | | | | - | - | - |
| Nov-12 | 13 | | | | - | - | - |
| Nov-12 | 14 | | | | - | - | - |
| Nov-12 | 15 | | | | - | - | - |
| Nov-12 | 16 | | | | - | - | - |
| Nov-12 | 17 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Nov-12 | 18 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Nov-12 | 19 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Nov-12 | 20 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Nov-12 | 21 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Nov-12 | 22 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Nov-12 | 23 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Nov-12 | 24 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Nov-12 | 25 | 0.41 | 0.55 | 0.55 | 5.43 | 14.67 | 20.11 |
| Nov-12 | 26 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Nov-12 | 27 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Nov-12 | 28 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Nov-12 | 29 | 0.60 | 1.15 | 0.55 | 11.94 | 31.08 | 43.03 |
| Nov-12 | 30 | 0.40 | 0.87 | 0.55 | 5.21 | 23.42 | 28.63 |
| Dec-12 | 1 | 0.40 | 0.71 | 0.55 | 5.21 | 19.05 | 24.25 |
| Dec-12 | 2 | 0.60 | 0.40 | 0.55 | 11.94 | 10.57 | 22.51 |
| Dec-12 | 3 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Dec-12 | 4 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Dec-12 | 5 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Dec-12 | 6 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Dec-12 | 7 | 0.45 | 0.70 | 0.55 | 6.46 | 18.78 | 25.24 |
| Dec-12 | 8 | 0.40 | 0.55 | 0.55 | 5.21 | 14.67 | 19.88 |
| Dec-12 | 9 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Dec-12 | 10 | 0.40 | 0.75 | 0.55 | 5.21 | 20.14 | 25.35 |
| Dec-12 | 11 | 0.50 | 0.49 | 0.55 | 8.01 | 13.03 | 21.04 |
| Dec-12 | 12 | 0.70 | 0.48 | 0.55 | 17.02 | 12.76 | 29.78 |
| Dec-12 | 13 | 0.55 | 0.49 | 0.55 | 9.83 | 13.03 | 22.86 |
| Dec-12 | 14 | 0.50 | 0.80 | 0.55 | 8.01 | 21.51 | 29.52 |
| Dec-12 | 15 | 0.80 | 1.05 | 0.55 | 23.23 | 28.35 | 51.58 |
| Dec-12 | 16 | 1.00 | 0.85 | 0.55 | 39.07 | 22.88 | 61.94 |
| Dec-12 | 17 | 0.75 | 0.67 | 0.55 | 19.98 | 17.95 | 37.94 |



| | | | | | | | |
|--------|----|------|------|------|--------|-------|--------|
| Dec-12 | 18 | 0.90 | 1.33 | 0.55 | 30.58 | 36.01 | 66.59 |
| Dec-12 | 19 | 0.74 | 1.15 | 0.55 | 19.40 | 31.08 | 50.48 |
| Dec-12 | 20 | 1.13 | 1.16 | 0.55 | 51.80 | 31.36 | 83.15 |
| Dec-12 | 21 | 1.29 | 1.31 | 0.55 | 70.10 | 35.46 | 105.56 |
| Dec-12 | 22 | 0.81 | 0.97 | 0.55 | 23.92 | 26.16 | 50.07 |
| Dec-12 | 23 | 0.68 | 0.58 | 0.55 | 15.91 | 15.49 | 31.41 |
| Dec-12 | 24 | 1.05 | 1.32 | 0.55 | 43.74 | 35.73 | 79.47 |
| Dec-12 | 25 | 0.86 | 0.98 | 0.55 | 27.50 | 26.43 | 53.94 |
| Dec-12 | 26 | 1.15 | 0.74 | 0.55 | 53.93 | 19.87 | 73.80 |
| Dec-12 | 27 | 0.58 | 0.81 | 0.55 | 11.07 | 21.78 | 32.85 |
| Dec-12 | 28 | 0.62 | 0.95 | 0.55 | 12.87 | 25.61 | 38.48 |
| Dec-12 | 29 | 1.04 | 0.67 | 0.55 | 42.78 | 17.95 | 60.73 |
| Dec-12 | 30 | 1.00 | 0.80 | 0.55 | 39.07 | 21.51 | 60.58 |
| Dec-12 | 31 | 1.40 | 1.40 | 0.55 | 84.38 | 37.92 | 122.30 |
| Jan-13 | 1 | 1.32 | 1.15 | 0.55 | 73.86 | 30.95 | 104.81 |
| Jan-13 | 2 | 1.00 | 0.85 | 0.55 | 39.07 | 22.88 | 61.94 |
| Jan-13 | 3 | 0.93 | 0.81 | 0.55 | 33.01 | 21.78 | 54.79 |
| Jan-13 | 4 | 0.91 | 0.76 | 0.55 | 31.38 | 20.42 | 51.79 |
| Jan-13 | 5 | 1.74 | 1.75 | 1.05 | 137.20 | 47.49 | 184.69 |
| Jan-13 | 6 | 1.18 | 1.06 | 0.73 | 57.21 | 28.62 | 85.83 |
| Jan-13 | 7 | 0.80 | 0.66 | 0.55 | 23.23 | 17.68 | 40.91 |
| Jan-13 | 8 | 0.56 | 0.48 | 0.55 | 10.03 | 12.62 | 22.65 |
| Jan-13 | 9 | 0.70 | 0.80 | 0.55 | 17.02 | 21.51 | 38.53 |
| Jan-13 | 10 | 0.59 | 0.53 | 0.55 | 11.50 | 14.13 | 25.63 |
| Jan-13 | 11 | 0.82 | 0.76 | 0.55 | 24.61 | 20.42 | 45.03 |
| Jan-13 | 12 | 1.27 | 1.08 | 0.55 | 67.66 | 29.17 | 96.82 |
| Jan-13 | 13 | 0.79 | 0.77 | 0.55 | 22.56 | 20.69 | 43.25 |
| Jan-13 | 14 | 0.95 | 0.92 | 0.55 | 34.68 | 24.79 | 59.47 |
| Jan-13 | 15 | 1.00 | 1.14 | 0.55 | 39.07 | 30.81 | 69.88 |
| Jan-13 | 16 | 0.85 | 1.10 | 0.55 | 26.76 | 29.72 | 56.48 |
| Jan-13 | 17 | 1.05 | 1.06 | 0.55 | 43.74 | 28.62 | 72.36 |
| Jan-13 | 18 | 0.99 | 1.04 | 0.55 | 38.17 | 28.07 | 66.24 |
| Jan-13 | 19 | 0.72 | 1.19 | 0.55 | 18.17 | 32.18 | 50.35 |
| Jan-13 | 20 | 0.61 | 1.21 | 0.55 | 12.40 | 32.72 | 45.12 |
| Jan-13 | 21 | 0.57 | 1.04 | 0.55 | 10.44 | 28.07 | 38.51 |
| Jan-13 | 22 | 0.55 | 1.01 | 0.55 | 9.83 | 27.25 | 37.09 |
| Jan-13 | 23 | 1.35 | 1.40 | 0.55 | 77.72 | 37.92 | 115.64 |
| Jan-13 | 24 | 1.50 | 1.35 | 0.55 | 98.55 | 36.55 | 135.10 |
| Jan-13 | 25 | 0.51 | 0.85 | 0.55 | 8.35 | 22.88 | 31.23 |
| Jan-13 | 26 | 0.52 | 0.75 | 0.55 | 8.70 | 20.14 | 28.85 |
| Jan-13 | 27 | 0.50 | 1.22 | 0.55 | 8.01 | 33.00 | 41.00 |



| | | | | | | | |
|--------|----|------|------|------|-------|-------|--------|
| Jan-13 | 28 | 1.15 | 0.65 | 0.55 | 53.93 | 17.41 | 71.33 |
| Jan-13 | 29 | 1.50 | 0.71 | 1.05 | 98.55 | 19.05 | 117.60 |
| Jan-13 | 30 | 1.36 | 0.83 | 1.42 | 79.03 | 22.19 | 101.22 |
| Jan-13 | 31 | 1.23 | 1.20 | 1.03 | 62.90 | 32.45 | 95.35 |
| Feb-13 | 1 | 1.08 | 1.06 | 0.55 | 46.67 | 28.62 | 75.29 |
| Feb-13 | 2 | 1.18 | 1.19 | 0.55 | 57.21 | 32.18 | 89.38 |
| Feb-13 | 3 | 1.17 | 1.30 | 0.55 | 56.10 | 35.05 | 91.15 |
| Feb-13 | 4 | 0.72 | 1.20 | 0.55 | 18.17 | 32.45 | 50.62 |
| Feb-13 | 5 | 0.67 | 1.16 | 0.55 | 15.38 | 31.36 | 46.73 |
| Feb-13 | 6 | 0.61 | 1.09 | 0.55 | 12.40 | 29.44 | 41.84 |
| Feb-13 | 7 | 0.53 | 0.85 | 0.55 | 9.07 | 22.88 | 31.95 |
| Feb-13 | 8 | 0.51 | 0.65 | 0.55 | 8.35 | 17.41 | 25.76 |
| Feb-13 | 9 | 0.85 | 0.55 | 0.55 | 26.76 | 14.67 | 41.44 |
| Feb-13 | 10 | 1.20 | 0.85 | 0.55 | 59.45 | 22.88 | 82.33 |
| Feb-13 | 11 | 1.10 | 0.55 | 0.55 | 48.69 | 14.67 | 63.36 |
| Feb-13 | 12 | 0.57 | 0.60 | 0.55 | 10.64 | 16.04 | 26.68 |
| Feb-13 | 13 | 0.69 | 0.76 | 0.55 | 16.46 | 20.42 | 36.88 |
| Feb-13 | 14 | 0.61 | 0.65 | 0.55 | 12.40 | 17.41 | 29.81 |
| Feb-13 | 15 | 0.71 | 0.46 | 0.55 | 17.59 | 12.21 | 29.80 |
| Feb-13 | 16 | 0.95 | 0.72 | 0.55 | 34.68 | 19.32 | 54.00 |
| Feb-13 | 17 | 1.14 | 0.89 | 0.55 | 52.86 | 23.97 | 76.83 |
| Feb-13 | 18 | 1.15 | 0.98 | 0.55 | 53.93 | 26.43 | 80.36 |
| Feb-13 | 19 | 1.12 | 1.04 | 0.55 | 50.75 | 28.07 | 78.82 |
| Feb-13 | 20 | 1.01 | 0.94 | 0.55 | 39.98 | 25.34 | 65.32 |
| Feb-13 | 21 | 1.17 | 0.69 | 0.55 | 56.10 | 18.50 | 74.60 |
| Feb-13 | 22 | 1.14 | 1.15 | 0.55 | 52.86 | 31.08 | 83.94 |
| Feb-13 | 23 | 0.76 | 0.67 | 0.55 | 20.61 | 17.82 | 38.43 |
| Feb-13 | 24 | 0.78 | 0.61 | 0.55 | 21.90 | 16.31 | 38.21 |
| Feb-13 | 25 | 0.84 | 0.83 | 0.55 | 26.03 | 22.33 | 48.37 |
| Feb-13 | 26 | 0.95 | 1.02 | 0.55 | 34.68 | 27.53 | 62.21 |
| Feb-13 | 27 | 0.79 | 0.96 | 0.55 | 22.56 | 25.89 | 48.45 |
| Feb-13 | 28 | 0.85 | 0.65 | 0.55 | 26.76 | 17.41 | 44.17 |
| Mar-13 | 1 | 0.60 | 0.45 | 0.55 | 11.94 | 11.94 | 23.88 |
| Mar-13 | 2 | 0.55 | 0.49 | 0.55 | 9.83 | 13.03 | 22.86 |
| Mar-13 | 3 | 0.86 | 0.93 | 0.55 | 27.50 | 25.07 | 52.57 |
| Mar-13 | 4 | 0.94 | 1.15 | 0.55 | 33.84 | 31.08 | 64.92 |
| Mar-13 | 5 | 1.21 | 1.18 | 0.55 | 60.59 | 31.90 | 92.49 |
| Mar-13 | 6 | 0.98 | 1.04 | 0.55 | 37.28 | 28.07 | 65.35 |
| Mar-13 | 7 | 0.87 | 0.93 | 0.55 | 28.26 | 24.93 | 53.18 |
| Mar-13 | 8 | 1.11 | 1.10 | 0.55 | 49.71 | 29.72 | 79.43 |
| Mar-13 | 9 | 1.37 | 1.30 | 0.55 | 80.35 | 35.05 | 115.40 |



| | | | | | | | |
|--------|----|------|------|------|-------|-------|-------|
| Mar 13 | 10 | 1.25 | 1.24 | 0.55 | 65.25 | 33.54 | 98.80 |
| Mar 13 | 11 | 0.96 | 0.92 | 0.55 | 35.54 | 24.79 | 60.33 |
| Mar 13 | 12 | 1.04 | 0.97 | 0.55 | 42.30 | 26.16 | 68.46 |
| Mar 13 | 13 | 0.92 | 0.95 | 0.55 | 32.19 | 25.61 | 57.80 |
| Mar 13 | 14 | 1.19 | 1.16 | 0.55 | 58.32 | 31.36 | 89.68 |
| Mar 13 | 15 | 1.25 | 1.25 | 0.55 | 65.25 | 33.82 | 99.07 |
| Mar 13 | 16 | 0.91 | 0.84 | 0.55 | 31.38 | 22.60 | 53.98 |
| Mar 13 | 17 | 0.82 | 0.75 | 0.55 | 24.61 | 20.14 | 44.75 |
| Mar 13 | 18 | 0.76 | 0.86 | 0.55 | 20.61 | 23.15 | 43.76 |
| Mar 13 | 19 | 0.67 | 0.75 | 0.55 | 15.38 | 20.14 | 35.52 |
| Mar 13 | 20 | 0.69 | 0.65 | 0.55 | 16.19 | 17.41 | 33.59 |
| Mar 13 | 21 | 0.61 | 0.61 | 0.55 | 12.40 | 16.31 | 28.71 |
| Mar 13 | 22 | 0.59 | 0.56 | 0.55 | 11.50 | 14.95 | 26.45 |
| Mar 13 | 23 | 0.57 | 0.54 | 0.55 | 10.64 | 14.40 | 25.04 |
| Mar 13 | 24 | 0.55 | 0.51 | 0.55 | 9.83 | 13.58 | 23.41 |
| Mar 13 | 25 | 0.54 | 0.46 | 0.55 | 9.26 | 12.21 | 21.47 |
| Mar 13 | 26 | 0.60 | 0.92 | 0.55 | 11.94 | 24.79 | 36.74 |
| Mar 13 | 27 | 0.84 | 0.85 | 0.55 | 26.03 | 22.88 | 48.91 |
| Mar 13 | 28 | 0.96 | 1.03 | 0.55 | 35.54 | 27.80 | 63.34 |
| Mar 13 | 29 | 0.89 | 0.98 | 0.55 | 29.79 | 26.43 | 56.23 |
| Mar 13 | 30 | 1.05 | 1.07 | 0.55 | 43.74 | 28.89 | 72.63 |
| Mar 13 | 31 | 1.03 | 1.02 | 0.55 | 41.83 | 27.53 | 69.36 |
| Apr 13 | 1 | 0.75 | 0.78 | 0.55 | 19.98 | 20.96 | 40.95 |
| Apr 13 | 2 | 0.77 | 0.80 | 0.55 | 21.25 | 21.51 | 42.76 |
| Apr 13 | 3 | 0.85 | 0.84 | 0.55 | 26.76 | 22.60 | 49.37 |
| Apr 13 | 4 | 0.92 | 0.88 | 0.55 | 32.19 | 23.70 | 55.88 |
| Apr 13 | 5 | 0.86 | 0.83 | 0.55 | 27.50 | 22.33 | 49.83 |
| Apr 13 | 6 | 0.77 | 0.74 | 0.55 | 21.25 | 19.87 | 41.12 |
| Apr 13 | 7 | 0.72 | 0.69 | 0.55 | 18.17 | 18.50 | 36.67 |
| Apr 13 | 8 | 1.09 | 1.06 | 0.55 | 47.68 | 28.62 | 76.30 |
| Apr 13 | 9 | 1.00 | 1.03 | 0.55 | 39.07 | 27.80 | 66.87 |
| Apr 13 | 10 | 0.70 | 0.74 | 0.55 | 17.02 | 19.87 | 36.89 |
| Apr 13 | 11 | 0.71 | 0.68 | 0.55 | 17.59 | 18.23 | 35.82 |
| Apr 13 | 12 | 0.59 | 0.58 | 0.55 | 11.50 | 15.49 | 26.99 |
| Apr 13 | 13 | 0.57 | 0.55 | 0.55 | 10.64 | 14.67 | 25.32 |
| Apr 13 | 14 | 0.53 | 0.52 | 0.55 | 9.07 | 13.85 | 22.92 |
| Apr 13 | 15 | 0.85 | 0.48 | 0.55 | 26.76 | 12.76 | 39.52 |
| Apr 13 | 16 | 1.10 | 0.49 | 0.55 | 48.69 | 13.03 | 61.72 |
| Apr 13 | 17 | 1.00 | 1.15 | 0.55 | 39.07 | 31.08 | 70.15 |
| Apr 13 | 18 | 0.90 | 1.15 | 0.55 | 30.58 | 31.08 | 61.66 |
| Apr 13 | 19 | 0.80 | 0.95 | 0.55 | 23.23 | 25.61 | 48.84 |



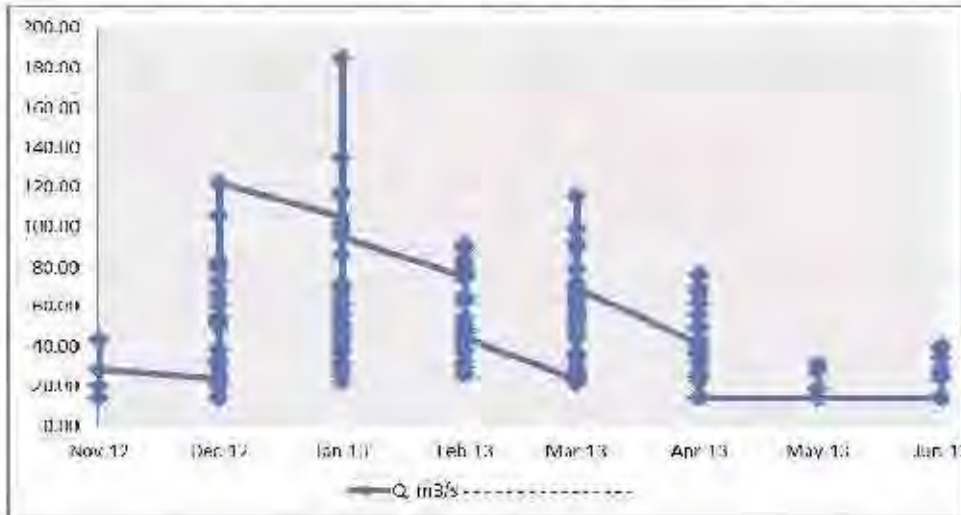
| | | | | | | | |
|--------|----|------|------|------|-------|-------|-------|
| Apr 13 | 20 | 0.60 | 0.75 | 0.55 | 11.94 | 20.14 | 32.09 |
| Apr 13 | 21 | 0.40 | 0.65 | 0.55 | 5.21 | 17.41 | 22.61 |
| Apr 13 | 22 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Apr 13 | 23 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Apr 13 | 24 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Apr 13 | 25 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Apr 13 | 26 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Apr 13 | 27 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Apr 13 | 28 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Apr 13 | 29 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Apr 13 | 30 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 1 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 2 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 3 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 4 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 5 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 6 | 0.70 | 0.53 | 0.55 | 17.02 | 14.13 | 31.15 |
| May 13 | 7 | 0.58 | 0.63 | 0.55 | 10.85 | 16.86 | 27.71 |
| May 13 | 8 | 0.45 | 0.45 | 0.55 | 6.46 | 11.94 | 18.40 |
| May 13 | 9 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 10 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 11 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 12 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 13 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 14 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 15 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 16 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 17 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 18 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 19 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 20 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 21 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 22 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 23 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 24 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 25 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 26 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 27 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 28 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 29 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| May 13 | 30 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |



| | | | | | | | |
|--------|----|------|------|------|-------|-------|-------|
| May 13 | 31 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 1 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 2 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 3 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 4 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 5 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 6 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 7 | 0.55 | 0.53 | 0.55 | 9.83 | 14.13 | 23.96 |
| Jun 13 | 8 | 0.75 | 0.73 | 0.55 | 19.98 | 19.60 | 39.58 |
| Jun 13 | 9 | 0.69 | 0.69 | 0.55 | 16.46 | 18.50 | 34.96 |
| Jun 13 | 10 | 0.58 | 0.55 | 0.55 | 11.07 | 14.67 | 25.74 |
| Jun 13 | 11 | 0.85 | 0.47 | 0.55 | 26.76 | 12.48 | 39.25 |
| Jun 13 | 12 | 0.60 | 0.65 | 0.55 | 11.94 | 17.41 | 29.35 |
| Jun 13 | 13 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 14 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 15 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 16 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 17 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 18 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 19 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 20 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 21 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 22 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 23 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 24 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 25 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 26 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 27 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 28 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 29 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |
| Jun 13 | 30 | 0.40 | 0.35 | 0.55 | 5.21 | 9.20 | 14.41 |



Figure 12 . Average Daily discharge at Lalela River during the period of observation



4.3 Manning's Coefficient Estimation

The estimation manning's coefficient or N value is very important in the hydraulic design of the system. For the uniform steady state condition, the discharge in any giver river can be calculated by the following equation, which can also be used to calculate the discharge for non-uniform flow by modifying the head loss due to bed friction (Jarrett and Petsch 1985)

$$Q = \frac{1}{n} \cdot AR^{2/3} S_f^{1/2}$$

Where: Q = discharge

n = manning's coefficient

A = cross section area

R = hydraulic radius

The friction slope, S_f is defined as follow:



$$s_f = \frac{h_f}{L} = \frac{\Delta h + \Delta h_v - k(\Delta h_v)}{L} ;$$

Where:

Δh = the difference elevation of water surface

Δh_v = the difference friction loss due to velocity at two points = $\frac{(V_2^2 - V_1^2)}{2g}$

K = coefficient of extraction (0.5 or 1). Note that the selection K value does not affect very much on the estimated manning's coefficient.

L = the length between each reach station

Field measurement need to be established in order to collect the require data for the estimation of the N value. To do that, minimum two measurement station (upstream and downstream) would be needed. Fort this work, we proposed two points of measurement (Upstream and Downstream).

The estimation of manning's coefficient of Laleia River was based on two assumption;

- The energy gradient of 1/200
- Based on direct measurement of energy gradient, which was 1/100

Table 9 Field data collected and Calculated N based on Friction slope 1/200

| Date of data taken | W, m | V, m/s | D, m | P, m | A, m ² | Rh, m | Q, cms | N |
|--------------------|------|--------|------|-------|-------------------|----------|--------|-------|
| 29-Dec-12 | 33.2 | 0.94 | 0.4 | 34 | 13.28 | 0.390588 | 12.23 | 0.041 |
| 11/1/2013 | 38.5 | 1.5 | 1.2 | 40.9 | 46.2 | 1.129584 | 69.3 | 0.051 |
| 15/1/2013 | 56 | 1.39 | 1.37 | 58.74 | 76.72 | 1.306095 | 124.58 | 0.052 |
| 30/1/2013 | 64.8 | 1.194 | 0.4 | 65.6 | 25.92 | 0.395122 | 30.93 | 0.032 |
| 12/2/2013 | 62.8 | 0.72 | 0.28 | 63.36 | 17.584 | 0.277525 | 11.84 | 0.017 |
| 27/2/2013 | 82.4 | 0.802 | 0.32 | 83.04 | 26.368 | 0.317534 | 19.29 | 0.058 |
| 3/12/2013 | 76.3 | 1.26 | 0.78 | 77.86 | 59.514 | 0.764372 | 36.57 | 0.042 |
| 26/3/2013 | 56.8 | 0.85 | 0.33 | 57.46 | 18.744 | 0.32621 | 14.83 | 0.038 |

The calculation in the above table suggested that manning coefficient of Laleia River during the flood event is in the range of 0.03-0.05.



Regardless of the method, the field data collection of discharge, cross section area of flow, perimeter, and depth are need in order to calculate the manning's' coefficient.

Figure 13. Plan view of the cross section

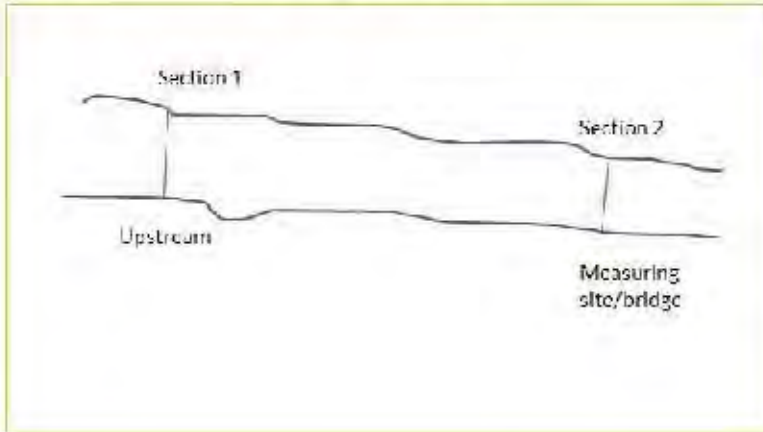
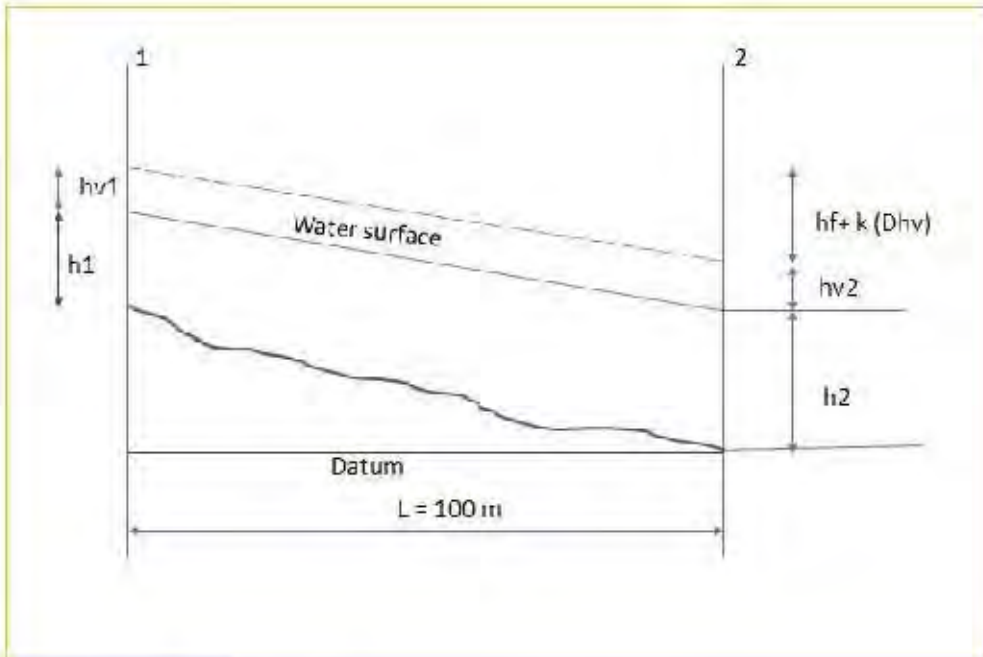


Figure 14. Detail of plan view of the cross section



Procedure to be followed:



1. Give/draw the profile of river with the measured data
2. Calculation of perimeter
3. Calculation of cross section
4. Calculation of flow
5. Calculation of energy gradient
6. Calculation of N value

Equation use to calculate the N:

$$n = \frac{1}{Q} \sqrt{\frac{(h_1 + h_{v1}) - (h_m + h_{vm}) - \sum_{i=2}^m (k_{z_{i-1}} \Delta h_{v_{i-1,i}})}{\sum_{i=2}^m \frac{L_{i-1,i}}{Z_{i-1} Z_i}}$$

Where:

$$Z = AR^{2/3}$$

For m = 2, the above equation can be simplified as followed:

$$n = \frac{1}{Q_1} \sqrt{\frac{(h_1 + h_{v1}) - (h_2 + h_{v2}) - K_{1,2} \Delta h_{v1,2}}{\frac{L_{1,2}}{Z_{1,2} Z_2}}}$$

Table 10: N value of Laleia River for friction slope 1/200 (based on measurement of two points)

| Date of data taken | N | N-Based on Measurement (dH = 0.5 m) |
|--------------------|-------|-------------------------------------|
| 29-Dec-12 | 0.041 | 0.041 |
| 11/ 1/ 2013 | 0.051 | 0.051 |
| 15/1/2013 | 0.052 | 0.065 |
| 30/1/2013 | 0.032 | 0.038 |
| 12/2/2013 | 0.048 | 0.040 |
| 27/2/2013 | 0.058 | 0.043 |
| 3/12/2013 | 0.042 | 0.032 |
| 26/3/2013 | 0.038 | 0.048 |

The result suggest that the manning coefficient is range from 0.032-0.06, with the average at 0.045



If the friction slope was assumed 1/100, then the manning coefficient is presented in the following table:

Table 11 Manning's Coefficient for the Friction slope of 1/100

| Date of data taken | W, m | V, m/s | D, m | P, m | A, m ² | Rh, m | N-Based on Measurement (dH = 1 m) |
|--------------------|------|--------|------|-------|-------------------|--------|-----------------------------------|
| 29-Dec-12 | 33.2 | 0.94 | 0.4 | 34 | 13.28 | 0.3906 | 0.056 |
| 11/1/2013 | 38.5 | 1.5 | 1.2 | 40.9 | 46.2 | 1.1296 | 0.072 |
| 30/1/2013 | 64.8 | 1.194 | 0.4 | 65.6 | 25.92 | 0.3951 | 0.045 |
| 12/2/2013 | 62.8 | 0.72 | 0.28 | 63.36 | 17.584 | 0.2775 | 0.056 |
| 27/2/2013 | 82.4 | 0.802 | 0.32 | 83.04 | 26.368 | 0.3175 | 0.0497 |
| 3/12/2013 | 76.3 | 1.26 | 0.78 | 77.86 | 59.514 | 0.7644 | 0.037 |
| 26/3/2013 | 56.8 | 0.85 | 0.33 | 57.46 | 18.744 | 0.3262 | 0.054 |

The range of manning coefficient is in the range of 0.035-0.06, with the average of 0.042

The fluctuation of N (Manning's coefficient) is inevitable due to change of flow regime and change in the nature of the flow path, flow area, and flow depth. However, the current observation on the manning variability has not given some idea on the trend of the manning's coefficient in relation to the magnitude of the discharge.

Therefore, the computation of the flood depth of design flood discharge of certain ARI (Average Return interval) was based on the average N values determined from the field observation. Even so, there is still one remaining unknown data that may affect some degree to the calculation of the water depth of the design flood discharge, which is the surface water elevation different between the two points of measurement.

It is possible that the elevation difference between the upstream and downstream (at the bridge) has elevation difference between 0.5 and 1.0 meter. This assumption will provide the friction slope of 1/200 and 1/100 respectively. Therefore, the calculation of manning's coefficient and later the flood depth of certain design flood discharge were based on friction slope of 1/200 and 1/100. However, the different in the final result (N and H) is fairly significant, which will affect further steps in the design and construction.

Therefore, it is suggested to measure the elevation different between the two points of measurements and use the value that is very close to the measurement. The finding of



Manning's coefficient of Laleia River was compared with other river which already measured in the past.

Table 12 Comparison of V value of Laleia River to other major river

| River | N-value (Range) |
|---------------------------------|-----------------|
| Laleia | 0.03-0.06 |
| Clark Fork above Missoula, Mont | 0.03 |
| Columbia River at Vernita | 0.027 |
| Ohio | 0.035 |

Table 13: typical N values for some major River in California

| No. | Stream and location | Drainage area (sq mi) | Length of reach (ft) | Discharge (cfs) | Hydraulic radius (ft) | Manning n | $\frac{R}{100}$ |
|-----|---|-----------------------|----------------------|-----------------|-----------------------|-----------|-----------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| 1 | Austin Creek near Cazadero. | 63.1 | 288.0 | 6,050 | 5.90 | 0.036 | |
| | | | 290.0 | 1,370 | 2.70 | .038 | |
| | | | 295.0 | 868 | 2.91 | .036 | |
| | | | 303.0 | 672 | 1.38 | .038 | |
| 2 | Cache Creek at Yolo. | 1,138 | 270.0 | 2,180 | 4.26 | .020 | |
| | | | | 944 | 2.52 | .022 | |
| | | | | 277 | 1.02 | .022 | |
| 3 | Middle Fork Eel River below Black Butte River, near Coyote. | 367 | 309.5 | 3,010 | 4.58 | .035 | |
| | | | | 1,350 | 1.54 | .043 | |
| 4 | Kaweah River at Three Rivers. | 418 | 372.0 | 1,050 | 2.14 | .071 | |
| | | | | 839 | 1.94 | .067 | |
| | | | | 405 | 1.46 | .082 | |
| 5 | Kings River below North Fork. | 1,342 | 531.0 | 2,630 | 2.70 | .064 | |
| | | | 533.0 | 2,630 | 0.56 | .050 | |
| | | | 526.0 | 2,200 | 3.49 | .064 | |
| 6 | Merced River at Clarks bridge near Yosemite. | ----- | 248.0 | 1,340 | 3.22 | .044 | |
| | | | 256.0 | 1,340 | 3.69 | .036 | |
| | | | | 1,650 | 3.48 | .036 | |
| | | | 248.0 | 983 | 3.13 | .032 | |
| | | | 254.0 | 1,170 | 2.96 | .050 | |
| 7 | Merced River at Happy Isles bridge, near Yosemite. | 181 | 180.0 | 1,950 | 4.38 | .050 | |
| | | | 200.0 | 1,950 | 3.93 | .038 | |
| | | | 220.0 | 1,990 | 3.74 | .037 | |
| | | | | 1,340 | 3.28 | .060 | |

Typical N values of Natural River with the channel type and condition were suggested by Chow, 1959 and summarized in the following table.



Table 14: Generalized Mannings coefficient by Chow, 1959

Table 1 Suggested Manning *n* for natural streams (Chow, 1959).

| Type of channel and description | Minimum | Normal | Maximum |
|--|---------|--------|---------|
| Stream on plain | | | |
| Clean, straight, full stage, no riffs or deep pools | 0.025 | 0.030 | 0.035 |
| Same as above, but more stones and weeds | 0.030 | 0.035 | 0.040 |
| Clean, winding, some pools and shoals | 0.033 | 0.040 | 0.045 |
| Same as above, but more stones and weeds | 0.035 | 0.045 | 0.050 |
| Clean, winding, some pools and shoals, weeds and more stones | 0.045 | 0.050 | 0.060 |

Laleia River is natural that has stone, gravel, and sand that formed the bed, which typically have resistance coefficient (N) in the range of 0.03 to 0.06.

4.4 Design Flood Height Estimation

5-year ARI

100-year ARI

Using the formula of manning's equation to calculate the water depth, as follow:

$$Q_T = \frac{1}{n} (WD_T) \left(\frac{WD_T}{W + 2D_T} \right)^{2/3} S_f^{1/2}$$

Because the equation is non-linear, the process of trial and error should be employed to determine the depth (D).

$$f(D_T) = Q_T - \frac{1}{n} (WD_T) \left(\frac{WD_T}{W + 2D_T} \right)^{2/3} S_f^{1/2}$$

Where: T = average return period of design, year

W = river wide



D = depth of water (from the water surface to the river bed)

Sf = friction loss

QT = design flow

N = 0.042

Trial D value for $f(D)$ approach to zero:

Table 15 Calculate Flood Design depth of Laleia River (based on assumption that Sf = 1/200)

| Design ARI, yr | Q, cms | n | W, m | Sf | H, m |
|----------------|--------|-------|------|-------|------|
| 5 | 800 | 0.042 | 190 | 0.005 | 1.75 |
| 100 | 1500 | 0.042 | 190 | 0.005 | 2.56 |

For Sf = 1/100

Table 16 Calculated flood depth of different Sf (Sf=1/100)

| Design ARI, yr | Q | n | W, m | Sf | H |
|----------------|------|-------|------|------|------|
| 5 | 800 | 0.042 | 190 | 0.01 | 1.42 |
| 100 | 1500 | 0.042 | 190 | 0.01 | 2.06 |

Table 17: Summary table of Flood depth with different Sf

| Sf | Q, cms | Flood Depth, m |
|-------|--------|----------------|
| 1/200 | 800 | 1.75 |
| | 1500 | 2.56 |
| 1/100 | 800 | 1.42 |
| | 1500 | 2.16 |



5. Finding and Conclusions Remarks

The hydrological data include stage-height (H), discharge (Q), and characteristics of Laleia river (N) were measured and determine in this project from period of November 2012 to June 2013. The raw data collected was used to derive the relationship between the stage height (H) and discharge of river (Q). The polynomial equations derived were then used to calculate the average daily discharge from the daily height observation during the period of observation.

The manning's coefficient that estimated from the field measurement was used to calculate the flood design height for 5- and 100-year return internal, which may be further used as an indication in the design of the hydrological structure of irrigation system in Buluto schemes.

Long-term continues data collection may be necessary to establish more general polynomial equation of stage (H) and discharge (Q) relation. Note that river characteristics such as flow area, flow depth kept changed from one storm to the other due to some existing flood protection work along the river which affect heavily the measurement. The existing flood protection work moved bed material at upstream of point measurement to the side of the river. The storm would remove the bed material and store back to the river but exactly along the point of measurement; thus the increasing the height of the bottom of the river (at the point of measurement) as compare to the baseline data (the original where the site was established). In order to generalize a polynomial equation for Laleia River, more long-term measurement would be needed.

6. Annexes

6.1 Data Table (Excel file): File attached

6.2 Figures:

6.3 Digital Photographs (Digital file attached)

資料 9 環境モニタリングフォーム

Monitoring Form - Construction Stage (every month)

Month: _____

Reporter: _____

Date: _____

| Item (rate) | Reporter | Monitoring Report | Judgment by MAF* |
|--------------------------|------------------------------|--|--|
| Air pollution | Contractor | Visual observation of dust at the construction sites: (<input type="checkbox"/> No air pollution / <input type="checkbox"/> Probable air pollution => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |
| Water pollution | Contractor | Visual observation of turbidity of water in the Laleia river at the bridge:: (<input type="checkbox"/> No water pollution / <input type="checkbox"/> Probable water pollution => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |
| Waste | Contractor | Volume of disordered waste at the construction sites: (<input type="checkbox"/> No waste problem / <input type="checkbox"/> Probable waste problem => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |
| Soil pollution | Contractor | Visual observation of soils at the construction sites: (<input type="checkbox"/> No soil pollution / <input type="checkbox"/> Probable soil pollution => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |
| Noise and vibrations | Contractor | Physical observation of noise and vibration at the construction sites: (<input type="checkbox"/> No noise or vibration problems / <input type="checkbox"/> Heavy noise of vibration => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |
| Involuntary resettlement | District Agr., Local Gov. | Record of meeting with residents: (to be attached) Records of grievances: (<input type="checkbox"/> No grievance / <input type="checkbox"/> Grievances made => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |

| Item (rate) | Reporter | Monitoring Report | Judgment by MAF* |
|--|------------------------------|---|--|
| Land use & utilization of local resources | District Agr., Local Gov. | Record of grievances: (<input type="checkbox"/> No grievance / <input type="checkbox"/> Grievances made => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |
| Water usage | District Agr. | Record of grievances: (<input type="checkbox"/> No grievance / <input type="checkbox"/> Grievances made => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |
| Existing social infrastructures & services | Contractor | Record of grievances: (<input type="checkbox"/> No grievance / <input type="checkbox"/> Grievances made => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |
| Social institutions | District Agr., Local Gov. | Record of grievances: (<input type="checkbox"/> No grievance / <input type="checkbox"/> Grievances made => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |
| Misdistribution of benefits & damages | District Agr., Local Gov. | Record of grievances: (<input type="checkbox"/> No grievance / <input type="checkbox"/> Grievances made => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |
| Local conflicts of interest | District Agr., Local Gov. | Record of grievances: (<input type="checkbox"/> No grievance / <input type="checkbox"/> Grievances made => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |
| Accidents | Contractor | Record of accidents: (<input type="checkbox"/> No accident / <input type="checkbox"/> Accidents occurred => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |

Remarks: Judgment by MAF: "A" = Confirmed as no problem; "B" = To be re-examined; "C" = To be solved

Note:

- The reporters (Contractor, District Agriculture Offices, and Local Administrations) shall fill the monitoring form every month, and submit it to the National Directorate of Irrigation and Water Management of the MAF.

- The National Directorate of Irrigation and Water Management of the MAF shall evaluate the report. If there are items to be re-examined, the Directorate shall inform the reporters to make detailed survey on the items. In case of any serious problems occurred, the Directorate shall take countermeasure to solve the problems in cooperation with related agencies.

Monitoring Form - Operation Stage (every three months)

Duration: _____

Reporter: _____

Date: _____

| Item (rate) | Reporter | Monitoring Report | Judgment by MAF* |
|---------------------------------------|------------------------------|---|--|
| Hydrometeor | District Agr., | Visual observation of water flow at the new intake weir in the Laleia river: (<input type="checkbox"/> No significant change / <input type="checkbox"/> Significant change => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |
| Involuntary resettlement | District Agr., Local Gov. | Record of grievances: (<input type="checkbox"/> No grievance / <input type="checkbox"/> Grievances made => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |
| Social institutions | District Agr., Local Gov. | Record of grievances: (<input type="checkbox"/> No grievance / <input type="checkbox"/> Grievances made => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |
| Misdistribution of benefits & damages | Local Gov. | Record of grievances: (<input type="checkbox"/> No grievance / <input type="checkbox"/> Grievances made => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |
| | District Agr. | Record of irrigation water supply: (<input type="checkbox"/> Supplied as planned / <input type="checkbox"/> Not supplied as planned => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |
| Local conflicts of interest | Local Gov. | Record of grievances: (<input type="checkbox"/> No grievance / <input type="checkbox"/> Grievances made => describe below) | <input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C |
| | District Agr. | Record of irrigation water supply: (Same as above) | |

Remarks: Judgment by MAF: "A" = Confirmed as no problem; "B" = To be re-examined; "C" = To be solved

Note:

- The reporters (Contractor, District Agriculture Offices, and Local Administrations) shall fill the monitoring form every three months, and submit it to the National Directorate of Irrigation and Water Management of the MAF.
- The National Directorate of Irrigation and Water Management of the MAF shall evaluate the report. If there are items to be re-examined, the Directorate shall inform the reporters to make detailed survey on the items. In case of any serious problems occurred, the Directorate shall take countermeasure to solve the problems in cooperation with related agencies.

資料 10 環境チェックリスト

Environmental Check List

| Category / Item | Check Item | Check | Reason / Mitigation Measure |
|-----------------------------------|---|--|---|
| Permit and Explanation | | | |
| EIA and environmental permit | <p>(a) Have EIA reports been already prepared in official process?</p> <p>(b) Have EIA reports been approved by authorities of the host country's government?</p> <p>(c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?</p> <p>(d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?</p> | <p>(a) Yes</p> <p>(b) (No)</p> <p>(c) (No)</p> <p>(d) No</p> | <p>(a) The MAF submitted the application form for environmental license to the National Directorate of Environment, and prepares the IEE report required under the law of the RDTL.</p> <p>(b) (c) The process for environmental license is going on, and has no problems so far. The license might be issued before the detailed design stage.</p> <p>(d) Not necessary.</p> |
| Explanation to local stakeholders | <p>(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders?</p> <p>(b) Have the comment from the stakeholders been reflected to the project design?</p> | <p>(a) Yes</p> <p>(b) Yes</p> | <p>(a) The MAF and local administrations held consultation meetings to explain the framework and potential impacts of the project.</p> <p>(b) Comments on land acquisition and allocation of irrigation water were taken into account for layout of the facilities.</p> |
| Examination of alternatives | Have alternative plans of the project been examined with social and environmental considerations? | Yes | <p>Shape of canals: The width of the canals was reduced by changing the cross section of canals from trapezoid to rectangle or by installing box culvert in the portion of residential area along the main canal.</p> <p>Layout of maintenance road: The length of the roads was reduced by use of existing roads for maintenance at some sections.</p> |
| Pollution Control | | | |
| Water quality | (a) Are considerations given to water pollution of river water and groundwater by effluent or leachates from agricultural lands? Are adequate use/disposal standards for fertilizers, agrochemicals, and livestock wastes established? Is a framework established to increase | <p>(a) No</p> <p>(b) Yes</p> | (a) (b) The Project has no effect on water quality in general. Only turbidity of water of the Laleia river shall be monitored during the construction stage. |

| Category / Item | Check Item | Check | Reason / Mitigation Measure |
|----------------------------|---|-----------------------------|---|
| | awareness of the standards among farmers? (b) Is a monitoring framework established for water pollution of rivers and groundwater? | | |
| Waste | (a) Are wastes properly treated and disposed of in accordance with the country's regulations? | (a) Yes | (a) Waste shall be managed in accordance with the law of Timor-Leste. The monitoring on water shall be carried out during at the construction sites. |
| Soil contamination | (a) Are there possible impacts in irrigated lands, such as salinization of soils will result? (b) Are adequate measures taken to prevent soil contamination of irrigated lands by agrochemicals, heavy metals and other hazardous substances? (c) Are any agrochemicals management plans prepared? Are any usages or any implementation structures organized for proper use of the plans? | (a) Yes (b) NA (c) NA | (a) No negative impact has been reported in the existing irrigation area and no additional impact is anticipated due to the rehabilitation project. (b) Because the project rehabilitate and improve irrigation systems only, the agrochemical management is not applicable. |
| Noise and vibration | (a) Do construction sites generate noise and vibration affecting to the residents? (b) Is there a possibility of noise or vibration problem in the new irrigation system? | (a) No (b) No | (a) Although serious impact on noise and vibration is not expected monitoring of noise and vibration level at the construction sites shall be carried out. (b) There are no facilities to generate significant noise and vibration. |
| Subsidence | (a) Is there a possibility of subsidence caused by extraction of groundwater? | (a) No | (a) No groundwater extraction is planned in the Project. |
| Odor | (a) Are there any odor sources? Is there a possible odor problems affecting the inhabitants? | (a) No | (a) This project will not generate any odor. |
| Natural environment | | | |
| Protected area | (a) Is the project site or discharge area located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas? | (a) No | (a) There is no protected area in the project area. |
| Ecosystem | (a) Does the project area encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project area encompass the | (a) No (b) No (c) No | (a) The project area falls outside of the forest. (b) Habitats of rare species are not included in the project area. |

| Category / Item | Check Item | Check | Reason / Mitigation Measure |
|---------------------------|---|---|--|
| | <p>protected habitats of endangered species designated by the country's laws or international treaties and conventions?</p> <p>(c) Is there a possibility that the project will result in the loss of breeding and feeding grounds for valuable wildlife?</p> <p>(d) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?</p> | (d) Yes | <p>(c) Breeding sites and feeding grounds of rare species are not lost by the project.</p> <p>(d) The project does not impact.</p> |
| Hydrometeor | (a) Is there possible impact on the flow of the Laleia river? | (a) Yes | (a) After construction of the intake weir in the Laleia river, the water flow might be changed in stream courses and discharge. it shall be monitored during the operation stage. |
| Topography and geology | <p>(a) Do the project affect topographic features of the project area?</p> <p>(b) Do the project affect geologic features of the project area?</p> | <p>(a) No</p> <p>(b) No</p> | <p>(a) No significant impact is anticipated on topographic conditions, because layout of the irrigation canals was changed not to excavate hills so much.</p> <p>(b) No impact is anticipated on geologic conditions.</p> |
| Social environment | | | |
| Resettlement | <p>(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is expected, are efforts made to minimize the impacts caused by the resettlement?</p> <p>(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?</p> <p>(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?</p> <p>(d) Is the compensations going to be paid prior to the resettlement?</p> <p>(e) Is the compensation policies prepared in document?</p> <p>(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?</p> | <p>(a) Yes</p> <p>(b) Yes</p> <p>(c) Yes</p> <p>(d) Yes</p> <p>(e) (No)</p> <p>(f) (No)</p> <p>(g) Yes</p> <p>(h) Yes</p> <p>(i) Yes</p> <p>(j) Yes</p> | <p>(a) Land acquisition (about 19 ha) of mainly forest and farmland is necessary to canals and maintenance road construction in some portions. The area to be acquired is minimized to arrange the layout of the facilities.</p> <p>(b) The public consultation meetings were carried out by the MAF.</p> <p>(c) The MAF prepares plan on land acquisition under the laws of the RDTL.</p> <p>(d) The MAF prepares necessary compensations on land acquisition under the laws of the RDTL.</p> <p>(e) (f) The MAF prepares shall prepare document on land acquisition under the laws of the RDTL soon.</p> <p>(g) The MAF surveyed land owners and started to talk with them about land acquisition.</p> <p>(h) The MAF prepares necessary organization and budget on land acquisition under the laws of the</p> |

| Category / Item | Check Item | Check | Reason / Mitigation Measure |
|---|--|---|---|
| | <p>(g) Are agreements with the affected people obtained prior to resettlement?</p> <p>(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?</p> <p>(i) Are any plans developed to monitor the impacts of resettlement?</p> <p>(j) Is the grievance redress mechanism established?</p> | | <p>RDTL.</p> <p>(i) The MAF plans to hold regular meetings with the residents during the construction and operation period.</p> <p>(j) The MAF and local administrations prepare grievance redress mechanism relating to land acquisition.</p> |
| Living and livelihood | <p>(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary?</p> <p>(b) Is there a possibility that the allotment will result in inequitable distribution or usurpation of land and available resources?</p> <p>(c) Is there a possibility that the allotments will result in inequitable distribution or usurpation of water rights and available resources?</p> <p>(d) Is there a possibility that the water use by the project will adversely affect downstream fisheries and water use?</p> <p>(e) Is there a possibility that water-borne or water-related diseases will be introduced? Is adequate consideration given to public health education, if necessary?</p> | <p>(a) No</p> <p>(b) No</p> <p>(c) No</p> <p>(d) No</p> <p>(e) No</p> | <p>(a) The stable and efficient irrigation water supply makes crop production larger.</p> <p>(b) This rehabilitation project does not affect land use.</p> <p>(c) The project aims more effective water use for irrigation, and water right of the Laleia river is given to the project through MAF's arrangement.</p> <p>(d) This rehabilitation project does not adversely affect economic activities in the downstream of the Laleia river.</p> <p>(e) No significant affect is expected because of no reservoir or ponds planned.</p> |
| Cultural heritage | <p>(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?</p> | <p>(a) No</p> | <p>(a) The project does not give impact because there are no such heritages in the project area.</p> |
| Landscape | <p>(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?</p> | <p>(a) No</p> | <p>(a) The project will not entail significant changes to the present landscape.</p> |
| Ethnic minorities and indigenous people | <p>(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?</p> <p>(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources</p> | <p>(a) No</p> <p>(b) No</p> | <p>(a) (b) There are no ethnic minority groups in the project area. The project will not change the rights of any groups in relation to land other resources.</p> |

| Category / Item | Check Item | Check | Reason / Mitigation Measure |
|----------------------------|---|---|---|
| | respected? | | |
| Working condition | <p>(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country?</p> <p>(b) Are tangible safety considerations in place for individuals involved in the project?</p> <p>(c) Are intangible measures being planned and implemented for individuals involved in the project?</p> <p>(d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?</p> | <p>(a) No</p> <p>(b) Yes</p> <p>(c) Yes</p> <p>(d) Yes</p> | <p>(a) (b) (c) (d) The implementation of the project considers the safety of the working individuals by conducting proper trainings on safety. Adequate trainings are given for equipment handling to avoid accidents. Security staffs are stationed in strategic location for proper implementation of safety in the project area.</p> |
| Others | | | |
| Impact during construction | <p>(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?</p> <p>(b) If construction activities adversely affect the natural environment, are adequate measures considered to reduce impacts?</p> <p>(c) If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts?</p> <p>(d) If the construction activities might cause traffic congestion, are adequate measures considered to reduce such impacts?</p> | <p>(a) Yes</p> <p>(b) Yes</p> <p>(c) Yes</p> <p>(d) Yes</p> | <p>(a) (b) (c) (d) The MAF and local administrations carry out regular monitoring during the construction stage. These measures will be executed so that it is less impacted.</p> |
| Monitoring | <p>(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?</p> <p>(b) What are the items, methods and frequencies of the monitoring program?</p> <p>(c) Does the proponent establish an adequate monitoring framework?</p> <p>(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?</p> | <p>(a) Yes</p> <p>(b) Yes</p> <p>(c) Yes</p> <p>(d) Yes</p> | <p>(a) Monitoring program by the MAF would be conducted.</p> <p>(b) Refer to the monitoring plan.</p> <p>(c) Monitoring framework would be established by the MAF including the budget plan.</p> <p>(d) Refer to the monitoring plan.</p> |

資料 11 住民協議議事録

(1) 2013年11月16日付議事録

Minutes of meeting on the Preparatory Survey for the Project for Rehabilitation of Buluto Irrigation Scheme in the Democratic Republic of Timor-Leste

[Date & hour] 16th November 2012,10:30-12:10

[Venue] Laleia Sub District Administration Office

[Attendance] 35 parsons, refer to Appendix

[Record of Meeting]

The JICA Survey Team (The Survey team) held the Public Meeting (Stakeholder Meeting) for the stakeholders in Laleia Sub District of Manatuto District concerned the Preparatory Survey for the Project for Rehabilitation of Buluto Irrigation Scheme.

After self introduction of the Survey team and guests, the Survey team explained on the objectives, outline and notable issues of the Project. Following that, Questions and Answers session were held. The meeting summary is as below.

1. Opening Address by Deputy Administrator of Laleia Sub District

2. Presentation on the Project by Consultants leader

Explanation of the objectives, outline and notable issues of the Project

3. Questions and Answers, Comment

- Attendant side talked to solve problem on coordination of irrigation water allocation in the project area in accordance with rules in local community.
- Furthermore, attendant side requested to leave three existing traditional irrigation canals and each intake facilities in the right side along Laleia river in the project area after completion of project irrigation facilities.
- The team asked for understanding that to unify the said three traditional irrigation canals and intake facilities will be national policy in order to advance as technical irrigation system.

- Inhabitant in the area requested to modify alignment of the proposed canal indicated by wooden pegs at present. The reason was the line indicated between the person's living place and farming plot therefore the canal would be block a passage of both places. The Survey team explained such comment will be caught at the time of land boundary confirmation survey in the field and others be scheduled for start from next week.
- Some attendants commented that in cases in which the alignment of proposed canal will be located within 2 to 3 meters from field plot band would be accepted. However, the person said that the location of alignment would be set out 10 meter from the band would be disagreed with the plan.
- One of the attendants requested the team to move the canal alignment to mountain side more due to reduce the provided canal area for new canal construction.
- In accordance with request of local inhabitants, the team consented to hold a traditional ceremony before the commencement of geological survey at proposed weir site. For this, the team asked for someone's presence of land owner or local key person.
- The survey team requested prohibition to all attendants to remove survey pegs of canal alignment placed by the team.

4. Closing remarks by Deputy Administrator of Laleia Sub District

Attendant List

| | <u>Name</u> | <u>Organization, Position</u> |
|----|---------------------------|-------------------------------|
| 1 | Oiraco Da Costa | Chefe Suco Laleia |
| 2 | Cosme Ximenes | MAE / OGL |
| 3 | Tito Clementis Da Silva | |
| 4 | Joao Gusmao | |
| 5 | Luciano Pereir | |
| 6 | Joao Elueomu F | |
| 7 | Antonio G Lops | |
| 8 | Floronco Md Barreiu | |
| 9 | Hideto Daiko | JICA TL |
| 10 | Youichi Yamauchi | Agriculture Promotion Adviser |
| 11 | Deolindo De Olivela | MAP |
| 12 | Ryosuke Sakanashi | JICA Study Team |
| 13 | Mitsuo Nishiya | JICA Study Team |
| 14 | Tomoaki Koyama | JICA Study Team |
| 15 | Motoo Taki | JICA Study Team |
| 16 | Marcelo C Ds | USP Manatuto |
| 17 | Katsuhiko Komatsu | JICA Study Team |
| 18 | Antonio Dc Bai | |
| 19 | Rita Da Costa | |
| 20 | Aurrlia Dc Gus | |
| 21 | Agapito Viegas | |
| 22 | Julio Gusmao | |
| 23 | Jose Da Costa | |
| 24 | Vicenti Gusmao | |
| 25 | Carlito Da Costa | |
| 26 | Vicenti Do Viegas | |
| 27 | Estefauia De Sousa | |
| 28 | Alcino De Sousa | |
| 29 | Jose Hengurici D.S | |
| 30 | Dowinggos Joao L Da Costa | Coote / Extensitnista Laleia |
| 31 | Alcino Olo Silva | Veteranos |
| 32 | Nivio Sapurnino Lopes | Staff Irrigation Maf |
| 33 | Takahiro Kato | JICA Study Team |
| 34 | Francisco A.X.D.C | Map/ Irrigacao |
| 35 | Gaspan Jdef Costa | Chefe Suco Hola-Ralao |

(2) 2013年11月22日付議事録

Minutes of meeting on the Preparatory Survey for the Project for Rehabilitation of Buluto Irrigation Scheme in the Democratic Republic of Timor-Leste

Date : November 22nd, 2012

Venue: Office of Vemasse Tasi Village

Attendants: 21 persons, refer to Appendix

1. Introduction

At first, Mr. Sakanashi as a Leader of JICA Consultant Team greets and welcomes for all participants who attend on this public consultation. On this consultation, JICA Consultant Team also appreciates for Mr. Vicente as an official of Irrigation and Water Management Department, MAF, and expresses his grateful for all attendants. After that Mr. Sakanashi kindly pleases to Mr. Vicente for providing a speech at ones opening the Preparatory Public Consultation. (Tetum version Material of the Preparatory Public Consultation was shared by the Team for all attendants)

2. Opening

As a greeting, Mr. Vicente attempts to really appreciate for JICA Team and all attendants on conducting public consultation as well as the preparatory survey which will be done by JICA. He urges to all participants to listen well the presentation will be presented by Mr. Sakanashi so that if having question or suggestion please don't hesitate deliver it to the Study Team and we are going to look for the adequate solution in order to cannot be impacted to this survey.

Mr. Vicente says that this program is realized incorporation between Government of Japan and Timor Leste but the principle investment of Irrigation scheme is funded by the people of Japan through JICA to the beneficiaries area like Vemasse and Laleia sub districts. This survey is a first stage of Japanese Grant Aid which led by Mr. Sakanashi and Team for beneficiary site. Otherwise last week we already fixed meeting schedule which conducting today consequently require much attention from Stakeholders, Village chiefs, Hamlet chiefs and important role also the farmers and land owners on attending this consultation. Finally, we kindly ask to The Leader of JICA Study Team to present the survey plan and thank you very much.

3. Three Main matters Presented by Leader of JICA Study Team; Mr. Sakanashi

1) Planning Survey and Design of Irrigation Scheme

2) Land Acquisition

3) Licenses and Corporation by Land owner, Aldeia and Village Chiefs

4. Discussing section

Mr. Jacinto Da Silva: (Local Water Association)

Firstly, I just inform to the JICA Consultant Team that the land owner did not agree even the alignment stick had install because the stick installed in the middle of their rice field, the land owners prefers to move the stick to the edge of field.

Secondly, as a Local Water Association member, I already informed to the land owners for attending on this consultation so that they could know detailed of survey plan and then deliver information which provided by Government to all farmers and land owners but some of them complain that they don't want if the canal will construct crossing by the middle of rice field because can be narrowing their rice field area and some of them also say that the construction canal its self is more strong or not because even already constructed but the quality is low then broken caused by flood when the rainy season water flow uncontrolled run everywhere to hit rice field.

Mr. Sebastião (Deputy Administrator of Vemasse sub district)

He unsatisfied about participation of beneficiary related on attending this meeting because there is no local authority including: Village, Aldeia Chiefs and land owners. He suggests that for the next future meeting, we try to invite them again for participating in the meeting so that they can get more information about the survey which will be done by JICA Consultant Team then they could be provided their suggestion because without them we cannot decide anything.

The Deputy Administrator also suggests that for the next future meeting in Vemasse, please after conducted meeting the JICA consultant team with the local authority and land owner will go directly to the project site to identify the owner of land.

Responded by Mr. Sakanashi as Presenter

The alignment of sticks is set just for survey matter in this case we need to conform the land owner and local leader to assist us on identifying which one as the land owner in this survey, its means that site for irrigation construction is not decided yet so that we really need land owner and local authority to allow for this survey, please share this information to the related beneficiary.

Regarding the canal quality, the Team is considering enhancement of the quality for main

canal using a masonry lining canal type.

According to Deputy Administrator, I kindly expect that Administrator can be organized Village chief, Aldeia chiefs and land owners and share information because we have just short time to this survey.

Mr. Benjamin (MAF District/Fishery Department)

He also comments about the land acquisition is acquired time to resolve so that propose to the local authority especially Administrator to conduct the internal meeting could be involved the local authority and land owner which not participated on this meeting so that may easy find out any kinds of solution then invite JICA Study Team to conduct meeting and survey in the next future.

The second suggestion is the canal which to be installed at the site more to upstream in the Vemasse river, please kindly move a little bit to upstream because if install in the site more to downstream the farmland which located at upstream cannot obtain water for their rice field so that may discriminate the farmer who the rice field located in upstream.

Thirdly, according to the presentation of Mr. Sakanashi on design of main canal and maintenance road with total width 12 meters, my suggestion is, if acceptable, to reduce the width to be 9 meters only so that cannot consume so much land area.

Responds from Mr. Sakanashi

I agreed with this opinion, Mr. Administrator please kindly organize your internal meeting after that inform to JICA Study Team to follow up. In other hand regarding to the site which located at the Vemasse bridge, this is still survey and we will decide when the result of water quantity and water head studying allowed us to install canal more upstream area in order to be not discriminated farmer who farmland located in the upstream area of bridge. And the suggestion to reduce the width of main canal and maintenance road, if the main canal is near with the existing road it's ok we can install only canal so that the width can be 9 meters therefore even no near existing road so we have to construct main canal and maintenance road because in the future Government of Timor Leste and JICA will establish Water Management Association to maintain irrigation canal so it's easy to do maintenance.

Mr. Luciano (Irrigation staff of MAF district of Baucau)

On behalf of all local authority and District Government I would like to express our sorry to The JICA Consultant Team for lacking participation of land owner and Suco, Aldeia chiefs. He requests that for the next meeting it must be organized and participated well by local authority and land owner so that easy to decided some decision related to the irrigation

project.

5. Closing

Mr. Vicente as an official of Irrigation & Water Management Department, MAF I express my grateful for the presentation of Mr. Sakanashi, I am expecting in the next meeting will be smoother and gained maximal participation of land owner and local leader related. I urge to all participants who attended this presentation please inform to who not attend in this meeting to elaborate, collaborate, corporate and contribute in this project. Finally thanks for everything and on behalf of Government and JICA Study Team will hear from your result of internal meeting and to follow up whatever your decision and officially close this consultation.

Mr. Sakanashi

Thank you for your participation and we are waiting for your follow up action on the next future meeting.

Attendant List

| | Name | Organization, Position |
|----|-----------------------|------------------------|
| 1 | Tomoaki Koyama | JICA Study Team |
| 2 | Katsuhiko Komatsu | JICA Study Team |
| 3 | Motoo Taki | JICA Study Team |
| 4 | Mitsuo Nishiya | JICA Study Team |
| 5 | Maria Cacilda Ximenes | Translator |
| 6 | Amancio Bruno | Translator |
| 7 | Cancio Soares | Ariculture |
| 8 | Apolinario | Agricultur |
| 9 | Bonifasio | Extensionit |
| 10 | Romaldo Freitas | Agricultur |
| 11 | Hermenegildo Correia | Agricultur |
| 12 | Francisco A.X.D.C | Teknika Irigasaun |
| 13 | Jancinto da Silva | Agriculture |
| 14 | Antonio Jose Lopez | CRP Baucau |
| 15 | Luciano Pereira | Irrigasaun Baucau |
| 16 | Benjamin Freitas | MAP Baucau |
| 17 | Joao Freitas | MAP Vemasse |
| 18 | R. Sakanashi | JICA Study Team |
| 19 | Sebastiao F. De. A | OGL |
| 20 | Vicente H. Guterres | DNIGA |
| 21 | Domingos da Silva | DNDL |

(3) 2013年12月12日付議事録

Minutes of Meeting on the Preparatory Survey on the Project for rehabilitation and improvement of Buluto Irrigation Scheme in the Democratic Republic of Timor-Leste

Date: December 12th, 2012

Venue: Office of Vemasse Tasi Village

Attendants: 47 persons, refer to Appendix

In this meeting is chaired by Mr. Carlos Freitas as a Vemasse Village Chief and Mr. Luciano as a chief of Irrigation section of Baucau. At first Mr. Carlos attempts to identify and check land owner which affected by Irrigation canal in Vemasse in consultation with Mr. João da Costa Freitas who as guider for Land Acquisition survey. After identified, some of land owner cannot attend because do others activity, so another meeting will conduct by village chief at December 14th, 2012.

Mr. Luciano explains to all attendants about the process of gaining this project, at first Government of Timor-Leste (MAF) already employed Indonesia Consultant to do survey for Buluto irrigation canal which had been located in Area of Laleia and Vemasse including others sub district in Baucau district. Therefore Buluto Irrigation scheme is chosen by Government of Japan in cooperate with Government of Timor Leste, although this survey is a part of Japanese Grant Aid. In order to implement the irrigation survey especially on land acquisition survey acquire land permitted by Land owner, so in this meeting please express your thinking about this case and we have to provide our land because we are the one as beneficiary of this project. Finally Mr. Luciano pleases to JICA Study Team to explain the alignment canal which affected to rice field.

Mr. Sakanashi, Chief consultant of the JICA Survey Team explained through show the alignment map of canal especially main canal is very important for construction with a width about 12 meter; around 7 m for main canal and 5 m for maintenance road, this survey is a preparatory study prior to Japanese Grant Aid before implementation of construction period at first we have to identify land owner which affected by irrigation canal, the purpose for settlement of alignment stick along to existing canal and at cross of rice field is a method to survey alignment canal. Mr. Sakanshi also explained that the important issue was the land owner provided their land when construction would be conducted and this is not the final survey, so we try to make conclusion at June, 2013 as the final survey. So now, we already identified the land owner then the next step is all listed name will discuss with Directorate of Irrigation and Water Management Dept. to have land owner approval, so in a part of Japanese side is waiting to land owner approval. In other hand, Mr. Kato, another team member reinforced by supplementary explanation that Japanese side only provides irrigation

water, please consider providing your approval, on relating to completion of irrigation scheme JICA also needs land for demonstration field and WUA office in order to as soft component program through capacity building. After that Mr. Kato asked to all farmer who ever cultivated hybrid paddy rice, otherwise he explain hybrid paddy rice is required more fertilizer and water for growing.

Discussion section

Mr. Agostinho João da Silva asks about upstream of road site, how you can provide water when the rice field more up than main canal therefore important is upstream also have to access for water.

Responded by Mr. Kato; regarding to upstream can't access water because gravity of water level will be lower 1.5 up to 2 m than ground level around the area. After that Mr. Sakanashi adds more respond that when JICA Study Team discussed with Government of Timor-Leste on this issue, the upstream is end of Government Timor-Leste so MAF will has counter plan to construct canal from Vemasse river to irrigate that field, so JICA only focuses on Buluto Irrigation Scheme.

Mr. Kato said on Swamp near sea area was difficult to cultivate due to poor drainage, so it is used for drainage flow area, it is OK for excluding in this project.

Responded by Mr. Jacinto Soares; It is no problem because that area for longtime ago unused for paddy cultivation.

Suggestion and question; Mr. Cosme as the land owner urges for all land owner to provide their land but still unclear about width area of canal its takes 12 meter in maximum, is the width including inside the rice field or not?

Additional explanation by Assistant of the Team on accordance with JICA Study Team; the width which we are talking now is main canal, the width including for maintenance road therefore if there is existing road closely with main canal so not necessary to construct maintenance road, the construction just focus on irrigation canal around 7 meters. On other hand the width which mentioned is not including for secondary or tertiary canals, it's depended on further study and design in Japan, even there is stock of budget so the main canal just construct the concrete canal then just expand the width for a little bit and secondary and tertiary will be improved same as existing earth canal in principal.

Mr. Antonio Lopes try to answer the hybrid paddy seeds it is certain required more water and fertilizer so who want to cultivate this variety must concentrate on commercial business. So there is advantage and disadvantage for local variety (sion) and hybrid, otherwise local variety is not gained more production if compare with hybrid.

Closing

Mr. Carlos closes the meeting and urges to who attended this meeting to inform them so that they can attend meeting at December 14, 2012 or other option I just send the vice Village chief to confirm and get acceptance. As a conclusion; who is not attended in this meeting only few percent and 90% of land owner agreed to provide their land.

Attendants List

| <u>No</u> | <u>Name</u> | <u>Organization/Position</u> |
|-----------|----------------------------|--|
| 1 | Carlos Freitas | Village Chief of Vemasse Tasi |
| 2 | Domingos da Silva | Representative of sub district Adm. Office |
| 3 | Bonefacio de Fátima | Sub district Extension worker |
| 4 | Jacinto da Silva | Coordinator of Traditional WUA of Vemasse |
| 5 | João da Costa Freitas | Vice of Village Chief |
| 6 | Romualdo da Costa Freitas | Community member |
| 7 | Aleixo Faria | Community member |
| 8 | Paulino da Costa Faria | Community member |
| 9 | Duarte Assunção C. Freitas | Hamlet Chief of Raha |
| 10 | João de Fátima Seran | Community member |
| 11 | Domingos Soares | Community member |
| 12 | Afonso Manuel Freitas | Teacher |
| 13 | Joanico Paecheco | Farmer |
| 14 | Hermenegildo Correia | Farmer |
| 15 | Domingos Belo | Farmer |
| 16 | Vitor Freitas | Farmer |
| 17 | Salvador da Silva | Farmer |
| 18 | Cosme Freitas | Farmer |
| 19 | Alfredo de Fátima Freitas | Farmer |
| 20 | Guilherme Soares | Farmer |
| 21 | Joaninho Freitas | Student |
| 22 | Maria Rosalia | Farmer |
| 23 | Lucas Soares | Farmer |
| 24 | Nazario Freitas | Farmer |
| 25 | Domingos I. Freitas | Land Owner |
| 26 | Feliciano da Silva | Farmer |
| 27 | Francisco D.C Freitas | Farmer |
| 28 | Tomas S. Freitas | Farmer |

| | | |
|----|-----------------------|-----------------------------------|
| 29 | João da Silva | Farmer |
| 30 | Salvador Soares | Farmer |
| 31 | Tomas Kehi | Farmer |
| 32 | Agustinho Z. Freitas | Farmer |
| 33 | Jóse da Costa Freitas | Farmer |
| 34 | Tomoaki Koyama | JICA Study Team |
| 35 | Ryosuke Sakanashi | JICA Study Team |
| 36 | Takahiro Kato | JICA Study Team |
| 37 | Amancio Bruno | Asst. Surveyor of JICA Study Team |
| 38 | António José Lopes | Crops Section of Baucau MAF |
| 39 | Luciano Pereira | Irrigation Section of Baucau MAF |
| 40 | Fernando M. Freitas | Farmer |
| 41 | Domingos L. Freitas | Farmer |
| 42 | Epoliano Freitas | Traditional WUA member |
| 43 | João Gaspar da Costa | Land Owner |
| 44 | Paulino Soares | Hamlet Chief |
| 45 | Filomeno Freitas | Farmer |
| 46 | Domingos Freitas | Traditional WUA member/Crala |
| 47 | Francisco Xavier | Traditional WUA member/Uai-Gae |