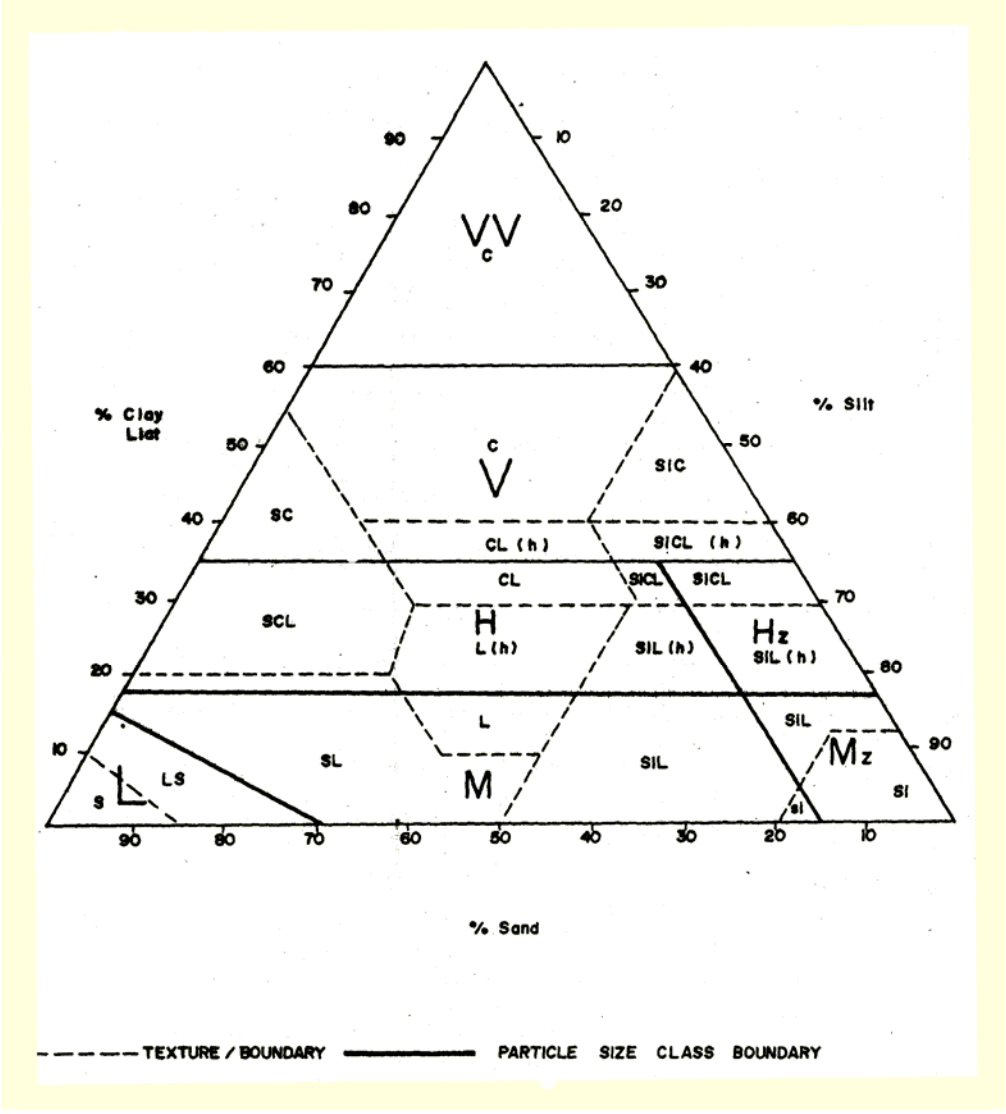
EARTHQUAKE AND TSUNAMI EMERGENCY SUPPORT PROJECT

ETESP

Soil Texture & Particle Size Class



April 2006

CONTENTS

ETESP Soil Texture and Particle Size Class (PSC)

1. INTRODUCTION

The texture of the soil describes the coarse and fine fractions that comprise the whole soil. That is, a texture might be:

- sandy clay loam
- clay
- gravelly loam
- very stony coarse sand
- extremely bouldery silty clay loam, and the coarse and fine fractions must be given.

Definitions of the various textures and the prefixes, which describe the coarse material or stone and gravel content, are given in this paper in Section 3.

Soil textures are grouped into Particle Size Classes (PSC) on the basis that some of the features of various textured soils are similar – such as the moisture holding capacity and cation exchange capacity. Again, PSC is defined and explained in Section 4.

The Particle Size Classes are one of the major criteria used in allocating soils to soil series and to using various ETESP tools. Details of various tools and systems are to be found in ETESP "Soils reports and Tools", April 2006. The tools are MS Excel spreadsheets and can be obtained from ETESP Agriculture office.

2. SOIL TEXTURE

In the field, soil texture is described by how the wetted soil feels to the touch and how it can be manipulated. A very rough guide as to how to determine the texture of the fine earth fraction is shown in Table 2.1 below. Definitions of the coarse fractions are given in Table 3.1 and the fine earth fractions are those particles smaller than 2mm and these are defined in Table 3.3.

Table 2.1 Rough Guide to Determine Texture of the Fine Earth Fraction

Wet or dry feel	Wet	Rolling by hand / finger	Texture	Symbol Refer below	PSC Refer below
Smooth and non-gritty to slightly gritty	Normally very sticky and plastic	Gives long threads which will bend into rings	Clay Silty Clay Sandy Clay	C ZC SC	VV and V
Slightly gritty	Moderately plastic	Gives threads with difficulty which will NOT easily bend into rings	Silty Clay Loam Clay Loam Sandy Clay Loam	ZCl CL SCl	Hz H
Smooth	Smooth	Forms threads with broken appearance	Silt Silt Loam	Z ZL	Mz
Gritty	Slightly plastic	Gives threads with great difficulty	Loam	L	M
More gritty	Not plastic, only slight cohesion	Gives threads with very great difficulty	Fine Sandy Loam Sandy loam	FsL SL	M
Very gritty	Forms a flowing mass with no cohesion	Does NOT give threads	Loamy Sand Sand	LS S	L

3. SOIL TEXTURES, SYMBOLS & PREFIXES

The texture of the soil is **not** just that of the fine earth fraction but of the whole combination of fine earth plus gravel, stone and boulder fractions. This is important when it comes to determining properties such as moisture holding capacity where the coarse material (gravel, stones and boulders) dilute the fine earth ability to retain moisture.

Table 3.1 Rough Guide to the Coarse Material Fractions

Name	Size	Rough Guide	Symbol	Note
Fine gravel	**2 – 6 mm 0.2 – 0.6 cm**	**Almost impossible to throw any distance**	**fgv**	
Medium gravel	**6 – 20 mm 0.6 – 2.0 cm**	**Difficult to throw any distance**	**mgv**	
Coarse gravel	**2 – 6 cm**	**Can be thrown by the handful**	**csgv**	
Gravel	**0.2 – 6 cm**	**Combination of above**	**g**	**Gravels normally combined as GRAVEL and the symbol "g" used**
Stones	**6 – 20 cm**	**Can be thrown individually**	**st**	
Boulders	**20 – 60 cm**	**Can be picked up with difficulty and care**	**bldr**	
Large Boulders	**>60 cm**	**Can not normally be picked up**	**csbldr**	

The symbols shown above are the same as found on the ETESP field description cards. However, it will not cause confusion if capital letters – for example "**C**sg" instead of "**c**sg" – are sometimes used. The classes of and symbols to be used to describe coarse material are presented below.

Table 3.2 Classes for Gravel, Stone and Boulder Contents

Description / Class	Symbol / Prefix	Content of Coarse Material*
Non-gravelly (stony, bouldery)		0 – 20%
Gravelly (Stony, Bouldery)	g (st, bldr)	20 – 35%
Very gravelly (stony, bouldery)	vg (vst, vbldr)	35 – 60%
Extremely gravelly (stony, bouldery)	xg (xst, xbldr)	60 – 90%

No prefix is used when non-gravelly, non-stony or non-bouldery soils are recorded.

Table 3.3 Definition of Fine Earth Fractions

ETESP				FAO		USDA	
Code	**Name**	**mm**	**microns**	**mm**	**microns**	**mm**	**microns**
FC	Fine clay	< 0.0002	< 0.2	< 0.0002	< 0.2	< 0.0002	< 0.2
C	Clay	< 0.002	< 2	< 0.002	< 2	< 0.002	< 2
FZ	Fine silt	0.002 - 0.02	2 -20	0.002 - 0.02	2 -20	0.002 - 0.02	2 - 20
CsZ	Coarse silt	0.02 - 0.05	20 - 50	0.02 - 0.063	20 - 63	0.02 - 0.05	20 - 50
VfS	Very fine sand	0.05 - 0.106	50 - 106	0.063 - 0.125	63 - 125	0.05 – 0.1	50 - 100
FS	Fine sand	0.106 – 0.212	106 - 212	0.125 - 0.2	125 - 200	0.1 – 0.25	100 - 250
MS	Medium sand	0.212 - 0.425	212- 425	0.2 - 0.63	200- 630	0.25 - 0.5	250 - 500
CS	Coarse sand	0.425 - 1.25	425 - 1250	0.63 - 1.25	630 - 1250	0.5 - 1	500 - 1000
VcS	Very coarse sand	1.25 - 2	1250 - 2000	1.25 - 2	1250 - 2000	1 - 2	1000 - 2000

FAO: Guidelines for Soil Profile Descriptions, FAO, Rome 1990
USDA: Soil Survey Manual, USDA Handbook No 18, 1951

A comprehensive list of soil textures, fine earth plus coarse material fractions, likely to be found in most situations is given in Table 3.4, and should be used on all field descriptions.

Table 3.4 Textures and Symbols Including Coarse Material Fractions

Fine earth name	Symbol	Texture with 0–20% gravel *	Texture with 20–35% gravel *	Texture with 35–60% gravel *	Texture with 60-90% gravel *
Very Fine Sand	VfS	VfS	gVfS	vgVfS	xgVfS
Fine Sand	FS	FS	gFS	vgFS	xgFS
Sand	S	S	gS	vgS	xgS
Medium Sand	MS	MS	gMS	vgMS	xgMS
Coarse Sand	CS	CS	gCS	vgCS	xgCS
Very Coarse Sand	VcS	VcS	gVcS	vgVcS	xgVcS
Loamy Very Fine Sand	LVfS	LVfS	gLVfS	vgLVfS	xgLVfS
Loamy Fine Sand	LFS	LFS	gLFS	vgLFS	xgLFS
Loamy Sand	LS	LS	gLS	vgLS	xgLS
Loamy Medium Sand	LMS	LMS	gLMS	vgLMS	xgLMS
Loamy Coarse Sand	LCS	LCS	gLCS	vgLCS	xgLCS
Loamy Very Coarse Sand	LVcS	LVcS	gLVcS	vgLVcS	xgLVcS
Very Fine Sandy Loam	VfSL	VfSL	gVfSL	vgVfSL	xgVfSL
Fine Sandy Loam	FSL	FSL	gFSL	vgFSL	xgFSL
Sandy Loam	SL	SL	gSL	vgSL	xgSL
Medium Sandy Loam	MSL	MSL	gMSL	vgMSL	xgMSL
Coarse Sandy Loam	CSL	CSL	gCSL	vgCSL	xgCSL
Very Coarse Sandy Loam	VcSL	VcSL	gVcSL	vgVcSL	xgVcSL
Silt Loam	ZL / SiL	ZL / SiL	gZL / SiL	vgZL / SiL	xgZL / SiL
Silt	Z / Si	Z / Si	gZ / Si	vgZ / Si	xgZ / Si
Loam	L	L	gL	vgL	xgL
Very Fine Sandy Clay Loam	VfSCL	VfSCL	gVfSCL	vgVfSCL	xgVfSCL
Fine Sandy Clay Loam	FSCL	FSCL	gFSCL	vgFSCL	xgFSCL
Sandy Clay Loam	SCL	SCL	gSCL	vgSCL	xgSCL
Medium Sandy Clay Loam	MSCL	MSCL	gMSCL	vgMSCL	xgMSCL
Coarse Sandy Clay Loam	CSCL	CSCL	gCSCL	vgCSCL	xgCSCL
Very Coarse Sandy Clay Loam	VcSCL	VcSCL	gVcSCL	vgVcSCL	xgVcSCL
Silty Clay Loam	ZCL	ZCL	gZCL	vgZCL	xgZCL
Clay Loam	CL	CL	gCL	vgCL	xgCL
Very Fine Sandy Clay	VfSC	VfSC	gVfSC	vgVfSC	xgVfSC
Fine Sandy Clay	FSC	FSC	gFSC	vgFSC	xgFSC
Sandy Clay	SC	SC	gSC	vgSC	xgSC
Medium Sandy Clay	MSC	MSC	gMSC	vgMSC	xgMSC
Coarse Sandy Clay	CSC	CSC	gCSC	vgCSC	xgCSC
Very Coarse Sandy Clay	VcSC	VcSC	gVcSC	vgVcSC	xgVcSC
Clay	C	C	gC	vgC	xgC

***Note**: For gravel one can replace with stones or boulders as appropriate.*

Textures are confirmed in the laboratory when the various percentages of the particles of sand, silt and clay are determined. The texture is then determined using a textural triangle and plotting the values of sand, silt and clay. Refer Figure 4.1.

4. USDA PARTICLE SIZE CLASSES

Many of the various textures have somewhat similar physical and chemical properties. For example, the physical properties of sand and loamy sand are not that different, similarly loam and sandy loam have similarities. Some of the more important properties in question being:

- AWHC – available water holding capacity, which is largely dependent on pores, pore size, surface area and size of particle present
- CEC – cation exchange capacity, which is largely dependent on clay content
- Infiltration rate, dependent on soil particle size and packing

In the USDA Soil Taxonomy system soil textures have been grouped into particle size classes (PSC) to help group soils with somewhat similar properties. For the determination of the PSC of a profile one has to use the “Control Section”. In the simplest way the “Control Section” can be defined as in Table 4.1.

The relationship between Soil Texture and PSC is shown in Figure 4.1 below and the definitions of the various Particle Size Classes are presented and defined in Table 4.2 on the following page.

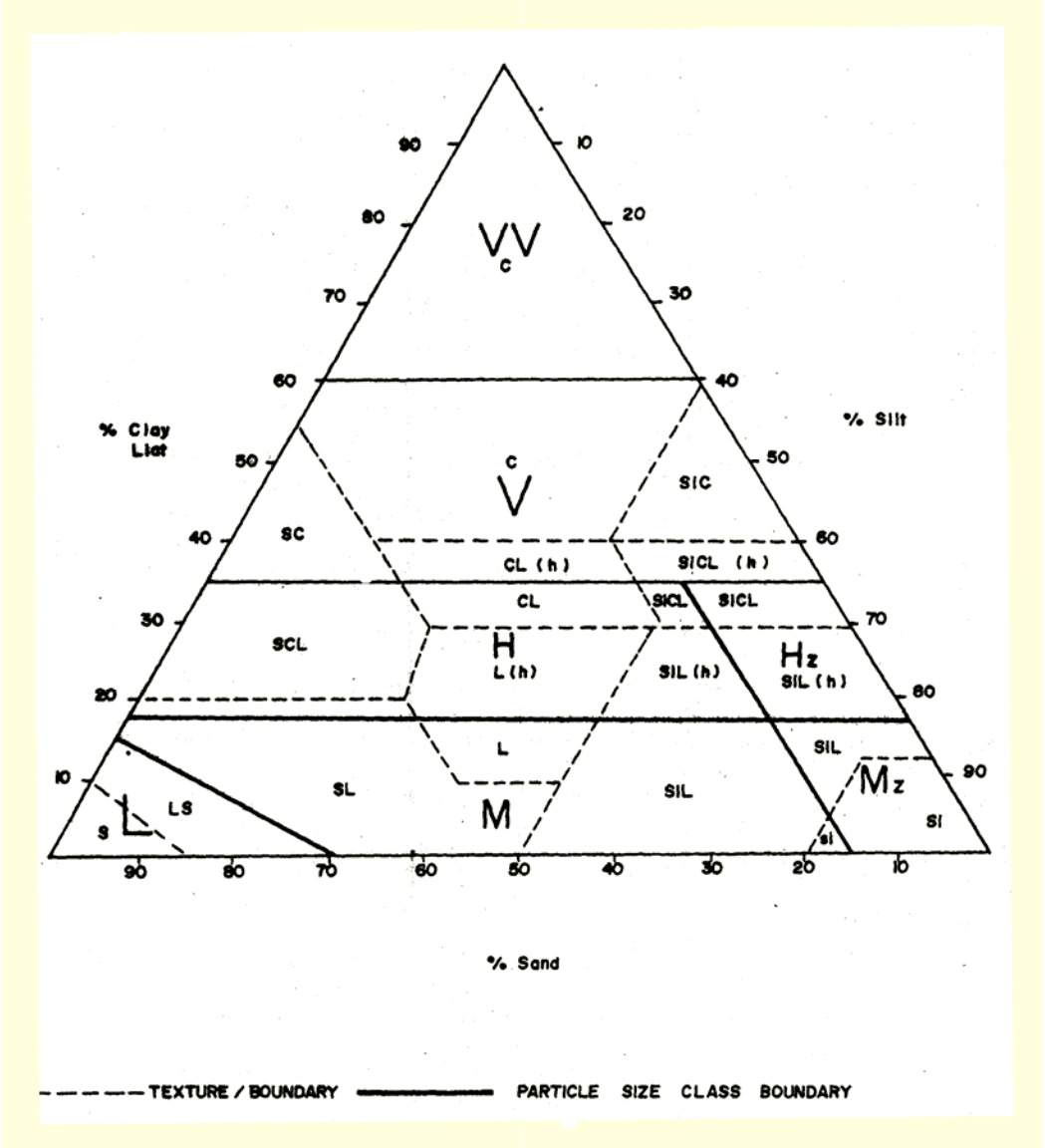
It must be noted that boundaries (percentages of clay in particular) between soil textures and PSC do not always coincide. For example:

- The boundary between Sl (sandy loam) and SCl (sandy clay loam) falls at 20% clay but the separation between coarse-loamy (M) and fine-loamy (H) falls at 18% clay.
- The lower limit for Cl (clay loam) is 30% clay with the upper limit at 40% clay but the PSC boundary between fine-loamy (H) and fine [or clayey] splits the clay loams in two at 35% clay giving Cl and Cl(h) – heavy clay loam.
- Similarly Zl (SiL) (silt loam) can fall into four PSC with M, H, Mz and Hz particle size classes whilst ZCl (silty clay loam) can be H, Hz or V.

Table 4.1 Control Section

Shallow Soils	Depth of Soil	Control Section
Shallow soils	< 36cm deep to contact with rock or other limiting material	Use the DOMINANT texture for PSC of the whole profile from surface to limiting layer.
Deep soils	> 36 cm deep	Use the DOMINANT texture for PSC in the 25 – 100cm depth section, or 25cm to a limiting layer if that occurs above 100 cm depth

Figure 4.1 Soil Texture and USDA Particle Size Class



Source: USDA Soil Taxonomy

Table 4.2 USDA Particle Size Classes

Symbol	Name	Definition	Textures	Gravel Content
V V	Very fine	>60% clay content	C (heavy)	0 – 35%
V	Fine (Clayey)	>35% but <60% clay content	C, SC, ZC, Cl (heavy), ZCl (heavy)	0 – 35%
Hz	Fine-silty	18 – 35% clay and <15% sand content	ZL (heavy), ZCl (heavy)	0 – 35%
H	Fine-loamy	18 – 35% clay content	MsCl, FsCl, CsCl, CL, L (heavy)	0 – 35%
Mz	Coarse-silty	<18% clay and <15% sand content	Z, ZL	0 – 35%
M	Coarse-loamy	<18%clay content	VfS, LvfS, VfsL, FsL, MsL, CsL, ZL, L	0 – 35%
Mh	Loamy	Shallow soils of <50cm depth with <35% clay content	MsL, FsL, CsL, ZL, L, MsCl, FsCl, CsCl, CL, L (heavy)	0 – 35%
L	Sandy	All sand textured soils with <50% VfS	FS, MS, CS, LfS, LmS, LcS,	0 – 35%
HL	Fine-loamy on sandy	**Strongly contrasting** H over L within control section and each layer at least 12.5cm thick	MsCl, FsCl, CsCl, CL, L (heavy) Over FS, MS, CS, LfS, LmS, LcS	0 – 35%
LH	Sandy on fine-loamy	**Strongly contrasting** with L over H within control section and each layer at least 12.5cm thick	FS, MS, CS, LfS, LmS, LcS **Over** MsCl, FsCl, CsCl, CL, L (heavy)	0 – 35%
VM	Fine on coarse-loamy	**Strongly contrasting** with V or VV over M within control section and each layer at least 12.5cm thick	C (heavy), C, SC, ZC, Cl (heavy), ZCl (heavy Over VfS, LvfS, VfsL, FsL, MsL, CsL, ZL, L	0 – 35%
MV	Coarse-loamy on fine	**Strongly contrasting** with M over V or VV within control section and each layer at least 12.5cm thick	VfS, LvfS, VfsL, FsL, MsL, CsL, ZL, L Over C (heavy), C, SC, ZC, Cl (heavy), ZCl (heavy	0 – 35%
Qv	Clayey-skeletal	Very or extremely gravelly, stony or bouldery with **V** or **VV** fine earth fraction	**Very or extremely gravelly, stony or bouldery** C (heavy), C, SC, ZC, Cl (heavy), ZCl (heavy	35 – 90%
Qmh	Loamy-skeletal	Very or extremely gravelly, stony or bouldery with H, Hz, M or Mz fine earth fraction	**Very or extremely gravelly, stony or bouldery** MsL, FsL, CsL, ZL, L, MsCl, FsCl, CsCl, CL, L (heavy)	35 – 90%
Ql	Sandy-skeletal	Very or extremely gravelly, stony or bouldery with L fine earth fraction	**Very or extremely gravelly, stony or bouldery** FS, MS, CS, LfS, LmS, LcS	35 – 90%
Q	Fragmental	> 90% gravel, stone or boulder content	Gravel, stones or boulders	>90%
Note	Strongly contrasting	One can have **Hz** and **Mz** instead of **H** and **M**	For strongly contrasting one PSC class must be missing between the two to qualify. That is L M, ML, MH, HM, HV do not qualify as the difference in textures is not that great.	

APPENDIX 1 ETESP REPORTS and TOOLS

1. ETESP Soil Desalinisation and Improvement Reports
1.1 Technical Data Reports

ETESP Agricultural Component, Desalinisation & Soil Improvement, Mobilisation Report, OCTOBER 2005 (Updated February 2006)

ETESP, Banda Aceh Kota, Kuta Alam, Data Assessment and Soil Reclamation, NOVEMBER 2005

ETESP, Aceh Besar Kabupaten, *Lhoknga, Darussalam and Baitissalam*, Data Assessment and Soil Reclamation, DECEMBER 2005

ETESP, Pidie Kabupaten, *Meureudu, Triang Gadeng, Panteraja and Simpang Tiga*, Data Assessment and Soil Reclamation, DECEMBER 2005 *[maps update of April 2006*]

ETESP, Bireuen Kabupaten, *Samalanga, Jeunieb, Jeumpa, Jangka and Ganda Pura*, Data Assessment and Soil Reclamation, DECEMBER 2005 *[maps update of April 2006*]

ETESP, Executive Summary, Soil and Land Reclamation, DECEMBER 2005

ETESP, Soil and Land Reclamation Scenarios, DECEMBER 2005 (Updated March 2006)

ETESP, Interpretation of Laboratory Data for ETESP Irrigation Component, FEBRUARY 2006 (Updated March 2006)

ETESP, Detailed Study of Laboratory Data, APRIL 2006

1.2 Background Technical Papers

ETESP, Background Paper, Annual & Monthly Rainfall, OCTOBER 2005

ETESP, Background Paper, Soil Acidity and Aluminium, DECEMBER 2005

ETESP, Digital Maps, FEBRUARY 2006 (Updated March 2006)

ETESP, Sandy Sediments, FEBRUARY 2006 (Updated March 2006)

ETESP, Soil Conditions for Wetland Rice, MARCH 2006

ETESP, Soil Texture and particle Size Class, April 2006

1.3 Site Visit and Tour Reports

ETESP, Site Visit Report – BRR Area at Lhoong: Kemukiman Cot Jeumpa, DECEMBER 2005

ETESP, Site Visit report, BLANG KREUNG SITE, DECEMBER 2005

ETESP, Tour Report, Field Tour Report NAD Areas, Feb 20th – Feb 24th 2006, FEBRUARY 2006

ETESP, Site Visit Report, Visit to Oxfam Sites Calang, MARCH 2006

ETESP, Site Visit Report, Visit to Red Cross Site, Aceh Besar, MARCH 2006

ETESP, Site Visit Report, Lhamno Irrigation Sites, Aceh Jaya, MARCH 2006

2. ETESP Soil Desalinisation and Improvement Tools

File name and date	Purpose
ETESP ECe from EM38 data.XLS OCTOBER 2005	Calculate soil salinity (ECe) values from raw data collected by EM38 salinity device when no calibration information provided
ETESP Leaching Water Requirements.XLS NOVEMBER 2005	Calculate the depths and volumes of water that have to be applied and pass through a selected depth of soil to achieve desalinisation. Information required includes: • Textural class of soil • Initial salinity of the soil (dS/m) • Target salinity wished to be achieved (dS/m)
ETESP Irrigation Leaching Progress.XLS NOVEMBER 2005	Determine how many irrigation gifts have to be applied to achieve de-salinisation of various depths of variously textured soil. Information required includes: • Soil textural group, or • AWHC (Available Water Holding Capacity) • Estimate of water application efficiency, or use default values • Size of irrigation gift as mm of water
ETESP Survey Density.XLS DECEMBER 2005	1. Correlate the scale at which to map surveys of various types from reconnaissance to very detailed level 2. Determine observation density (Sites / hectare) 3. Calculate the total number of sites for surveys at various reliability levels Requirements: • Survey area extent in hectares (ha) Also presents various map and mapping information
ETESP Labdata summary.XLS Version 4 FEBRUARY 2006	Enter standard laboratory data and obtain ratings as to the level of all the various nutrients and chemical properties. Also calculate weighted mean vales for topsoil and subsoil plus obtain automatic simple summary of: • Inherent fertility • Fertility potential • Possible nutrient deficiencies • Salinity status, and • Reaction Also experimental estimate of possible perceived risks

ETESP Site Monitoring tool.XLS MARCH 2006	Enter field data for specific sites or villages making note of : 1. <u>Locational information</u> • Kabupaten • Kecamatan • Desa • Farmer or Land-owner, and • Geographic coordinates 2. <u>Soil, land and crop features</u> • surface soil textural group • soil salinity • soil acidity • irrigation water quality (salinity) • status of drains, plus • estimate (%) of the actual pre-tsunami crop yield to monitor land reclamation progress and get information on further interventions possibly required
ETESP Soil Conditions Database MARCH 2006	Enter field collected on the site form, or data collated and analysed from the data on the site form into a format that will be the first stages of a dbms / GIS compilation: • surface soil textural group • soil salinity • soil acidity • irrigation water quality (salinity) • status of drains, plus • estimate (%) of the actual pre-tsunami crop yield The data are stored against the official Dinas selected villages that qualify for ETESP inputs. This collation will allow monitoring land reclamation progress within kecamatan and kabupaten and get information on further interventions possibly required
ETESP Auger Description Form MARCH 2006	Simple pro-forma for recording data collected during soil investigations to establish depths and distribution of sandy sediments
ETESP HRD Database, Training Needs MARCH 2006	Draft database design for recording the training needs of Dinas Pertanian staff in the various districts. Compiled in MS Access.
ETESP Survey Database MARCH 2006	Draft database design in MS Excel for recording data collected during any soil survey inspections or observations. Data being collected using the"Auger Description Form". If use was to be made of this database it could / should be recompiled in MS Access as this offers a more secure data storage medium.

ETESP Labdata Collation.XLS APRIL 2006	Enter standard laboratory data and obtain ratings as to the level of all the various nutrients and chemical properties pH ECe Exch H and Al Exch-cations Total-N Organic-C CEC TEB BS ASP ESP Ca:Mg ratios Mg:K ratios
ETESP Land & Soil Problem Assessment.xls	A spreadsheet designed as a DECISION TREE to allow the identification and categorisation of various soil and land problems associated with the tsunami. Remedial actions are then suggested as well as the appropriate tools to further check the situation and devise recovery routines.

Appendix 2 LIST OF ABBREVIATIONS

(Simple metric units and chemical element symbols not included*)*

Acre	Area of measurement, = 0.405 ha
aeolian	Windblown deposit. Usually high in coarse silt and very fine sand, i.e. 20-100 microns, stone-free, and sometimes ultraporous
Alluvial fan	Poorly stratified and sorted material deposited on floor of side valley
asl	Above sea level
ASP	Aluminium Saturation Percentage
AvP, AP	Available Phosphate
AWC	Available water capacity (amount of water held in soil at suctions low enough for root uptake, = MC% FC – MC% WP)
ETESP	Earthquake & Tsunami Emergency Support Project
BS%	Base saturation percentage
C	Clay (finest mineral particles in soils, < 2um in diameter, important store for some nutrients and water, make soils sticky & heavy to work)
CEC	Cation exchange capacity
CL	Clay loam
cm	Centimetre
Colluvium	Local hillwash, moved by surface erosion and slow non-glacial creep processes.
Complex	Soil mapping unit with several co-equal soil classes.
Concave	Slope form of dip on slope, with steep gradient upslope and gentle gradient downslope. Tends to accumulate water & be imperfectly or poorly drained.
Consociation	Soil mapping unit with one soil class dominant but others as minor constituents.
Convex	Slope form of protuberance on slope, with gentle gradient upslope and steep gradient downslope. Tends to shed water & be droughty.
Creep	Slow gravitational mass movement of colluvium downslope.
Ccv	Concave
Cvx	Convex
dbms	Database management system (Database)
EC	Electrical conductivity
ECEC	Effective cation exchange capacity (=TEB + Extr Al + Extr H)
Eluvial	Soil horizon formed by the washing out of some components
ET	Evapotranspiration
Evapotranspiration	Sum of evaporation from soil and other surfaces, and transpiration from leaves
Exch	Exchangeable (for cations)
Extr	Extractable (for soil nutrients)
FAO	Food & Agriculture Organisation, Framework for Land Evaluation, Soils Bulletin No. 32, FAO Rome 1976
FC	Field capacity (MC% at suction of 0.1 atmospheres)
Fine earth	Soil particle size < 2mm
Freely drained	Soils in which most large pores drain their water soon after rain or irrigation at all times of the year. Identified by moist or dry feel, and warm brown, reddish or yellowish colours and absence or grey, rust or orange mottles
FYM	Farmyard manure
Gley	Soil that is permanently wet, poorly aerated and has predominantly greyish colours, due to reduction of free iron to ferrous valency state. May have local oxidising conditions giving rust - coloured mottles, especially around root channels.
GPS	Global positioning system
ha	Hectare
HCl	Hydrochloric acid
Horizon	Soil layer
Illuvial	Soil horizon formed by enrichment of some components washed in from eluvial horizon(s) above
ID	Imperfectly drained (soil)
Imperfectly drained	Soils in which most large pores drain their water soon after rain or irrigation for much of the year, but remain filled for long spells in summer Identified by moist or wet feel, and grey or brown colours and many grey, rust or orange mottles.
In situ	In original position or place (Latin)
Interfluve	Land between two rivers, include halves of two valleys and ridge between them, (from Latin *inter* = between, *fluvius* = river)

L	Loam (Mixed soil with substantial quantities of all three particle size classes, i.e. clay, silt and sand)
MD / MWD	Moderately well drained (soil)
Munsell	System of standard soil colour notation, operated by matching soil against standard charts. Colour described by 'hue' (Spectral composition, red, yellow, blue, green); 'value' (dilution with white), & 'chroma' (darkness)
NA	Not applicable / Not applied
ND	No data / Not Determined
NS	Not sampled (in soil profile descriptions)
OC	Organic carbon
OM	Organic matter
P	Phosphate
PD	Poorly drained (soil)
PM	(Soil) Parent Material
Pptn	Precipitation, rainfall
pH	Measure of acidity - alkalinity
Profile	Sequence of horizons from surface down to unaltered parent material
Rectilinear	Straight slope with more or less similar gradients up- and downslope
Series	Main group of soil classes in Bhutan. Also sixth highest level of subdivision in USDA Soil Taxonomy.
Shrub	Broad-leaved plant with short woody stem, generally < 8 m high
Si	Silt (intermediate sized mineral particles in soils, 2 - 50 um in diameter, important store for plant available water, make soils slippery & vulnerable to surface erosion and capping, aka Z, Zi)
SMR	Soil Moisture Regime, defined in Soil Taxonomy
SMU	Soil mapping unit
Solifluction	Summer movement of saturated thawed surface material over top of permanently frozen subsoil. Occurs in periglacial conditions
Solum	True soil, in which soil processes have removed many traces of parent material structures.
SS	Soil Surveyor
ST	Soil Taxonomy (USDA system of soil classification)
STR	Soil temperature regime, defined in Soil Taxonomy
Surface wash	Movement of individual surface soil particles by running surface water.
SWXD / SXD	Somewhat excessively well drained (soil)
Tr	Trace
TEB	Total exchangeable bases (= exchangeable Ca + Mg + Na + K)
TN	Total nitrogen
Track	Series of coordinates as taken by a GPS device recording a traverse, boundary or road
USDA	United States Department of Agriculture
VPD	Very poorly drained (soil)
Waypoint	Geographic coordinates as taken by GPS device
WD	Well drained (soil)
WT	Water table
XD / XWD	Excessively well drained (soil)
Z, Zi	Silt (intermediate sized mineral particles in soils, 2 - 50 um in diameter, important store for plant available water, make soils feel slippery & vulnerable to surface erosion and capping, aka Si)