# EARTHQUAKE and TSUNAMI EMERGENCY SUPPORT PROJECT

# (ETESP)

## RED CROSS SITE – LAMBADEUK, ACEH BESAR


**(March 2006)**

**CONTENTS**

# VISIT TO RED CROSS SITE LAMBADEUK WEST OF BANDA ACEH

## 1. INTRODUCTION

### 1.1 Purpose of Visit

In March 2006 Red Cross contacted the ETESP Soil Desalinisation and Improvement Specialist with a request if he could advise and assist them with development and use of the soils on a site they were developing in Peukan Bada Kecamatan in Aceh Besar. Arrangements were made to visit the site on 11th March 2006. The activities around this site includes, new housing, road reconstruction, recent re-planting of mangrove and, it is intended, to attempt to kick-start agriculture on the site as part of "livelihood" development by Red Cross.

This "site visit" report has been compiled strictly from a technical point of view based on the observations made during the visit, plus any information extracted from existing mapping, and the Soils Specialist has not considered any implications of or on the strategies, plans or intentions of the involved NGOs, the ETESP (Earthquake and Tsunami Emergency Support Project, ADB) or Dinas Pertanian.

### 1.2. Location and Maps

The site in question lies some 7km west north west of the ADB Office in Banda Aceh, the route, as recorded by a GPS trace, can be seen in Figure 1.1

At present only the first few kilometres of the road is sealed and in reasonable condition – most of the road is in very poor condition, unsealed with many potholes and some sections are totally new, such as the part referred to as "causeway – WP105" in the "waypoint" notes. However, the site is accessible by road and the road should improve as work progresses.

The maps used in this report are all compiled in digital format and are accessed using the GPS Software "OziExplorer". The various maps are described in the ETESP background paper "Digital Mapping".

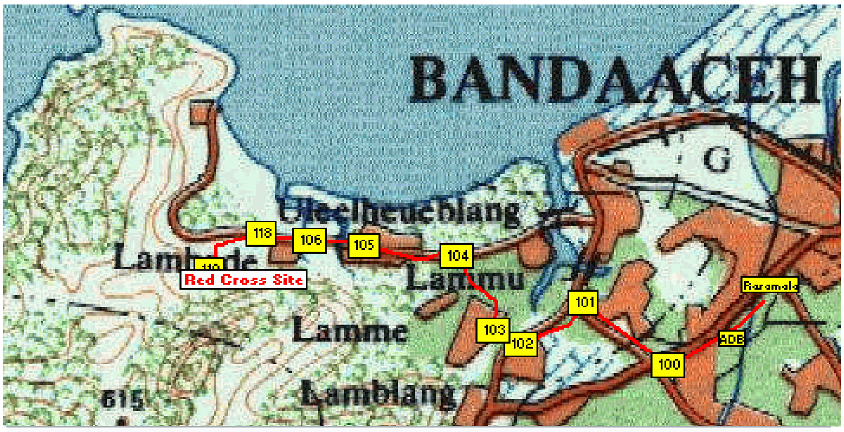
The map on the right is extracted from the digital copy of the Bakosurtanal topographic series at a scale of 1:250,000. Other maps are:

- Bakosurtanal 1:50,000 scale
- Recent tsunami impact mapping by the Indonesian Soil Research Institute (ISRI) Bogor, but the
- Satellite image was not good enough to download from Google Earth due to cloud cover.

The above sources are gratefully acknowledged.

As an indication of altitude accuracy it can be noted that the map shows the 25masl (metres above sea level) contour just entering the north-west corner of the site where the GPS reading was about 20masl

**Figure 1.1 Access to Site at Lambadeuk with Waypoint Data**




| Name | Latitude | Longitude | Alt(m) | Description |
|---|---|---|---|---|
| 1 | 5 32 16.6 | 95 18 28.2 | 16.0 | Rasamala Indah Hotel, Banda Aceh |
| 100 | 5 31 44.5 | 95 17 42.5 | 34.0 | Traffic lights |
| 101 | 5 32 14.5 | 95 17 01.4 | 29.9 | T junction, turn left |
| 102 | 5 31 54.7 | 95 16 32.3 | 29.9 | Y junction, go right |
| 103 | 5 32 01.1 | 95 16 18.5 | 28.0 | T junction, go right |
| 104 | 5 32 36.5 | 95 16 01.4 | 24.1 | Junction with monument, go left |
| 105 | 5 32 41.8 | 95 15 16.7 | 18.9 | Start of "causeway" |
| 106 | 5 32 44.1 | 95 14 50.8 | 18.0 | Desa Lamguron |
| 107 | 5 32 45.4 | 95 14 33.8 | 15.8 | Unflooded, dry area with new construction - "shelter" |
| 108 | 5 32 46.4 | 95 14 23.0 | 18.0 | Track to the left down edge of the site |
| 110 | 5 32 29.3 | 95 14 02.8 | 18.9 | Irrigation Offtake |
| 111 | 5 32 34.5 | 95 14 06.7 | 10.1 | Concrete water tank |
| 112 | 5 32 34.7 | 95 14 19.9 | 6.1 | Old, original earth drain - flooded |
| 114 | 5 32 33.6 | 95 14 20.5 | 6.1 | No in-field drain as close to main drain |
| 115 | 5 32 33.7 | 95 14 20.8 | 7.0 | Old, damaged field-drain leading to main drain |
| 116 | 5 32 33.3 | 95 14 21.6 | 7.0 | Above East-West aligned 2 metres drain which is flowing |
| 117 | 5 32 34.3 | 95 14 25.4 | 4.9 | North-South aligned drain of 75cm - 1.5metres depth |
| 118 | 5 32 47.1 | 95 14 27.9 | 6.1 | Damaged N-S drain meets road with concrete bridge |
| 119 | 5 32 41.0 | 95 14 18.9 | 7.9 | Mid site, N-S aligned possible old farm road or bund |
| 120 | 5 32 39.8 | 95 14 15.8 | 9.1 | Old field bunds indicating start of previous irrigated area |

Altitudes shown on the above are NOT to be taken as totally accurate as they are GPS derived and known to be inaccurate to some degree. However, some altitude differences can be extracted from the above:

- At a noted 18.9masl (metres above sea level) the irrigation off-take is the highest point measured on the site during this visit
- The lowest point recorded (4.9masl) was in the southern end of the N-S aligned drain, that is in the lower right or south-east corner of the location
- The land is actually sloping away from the sea and towards the hills and the river that is the source of the irrigation water. The N-S drain lies at 6.1masl where it meets the road and at 4.9m at the southern end

## 1.3 Locational Detail

The site lies between 1 and 1.5km from the ocean at only a few metres above sea level, although not accurate, the GPS data indicates that the highest point is the top or north-west corner (about 18masl), the water tank in the south west-corner is at about 10masl, where the N-S drain meets the road in the top or north-east corner is at 6masl whilst the lowest point is down in the south-east corner where the N-S drain discharges into the main drain. Basically the site slopes from the north-west, where the old padi bunds are noted in Figure 1.2, towards the south east corner below where the sandy deposits are noted.

It is assumed that the site comprises alluvial material washed out of the hills and deposited in the valley which lies between Goh Ba' Karieng and Lambade in Figure 1.2, but further more detailed soil (survey) studies or access to previous soil mapping would be required to confirm this.

As can be seen the whole area encompassing Lambaro and Lambade was mapped as "sawah" land on the 1:50,000 scale map.

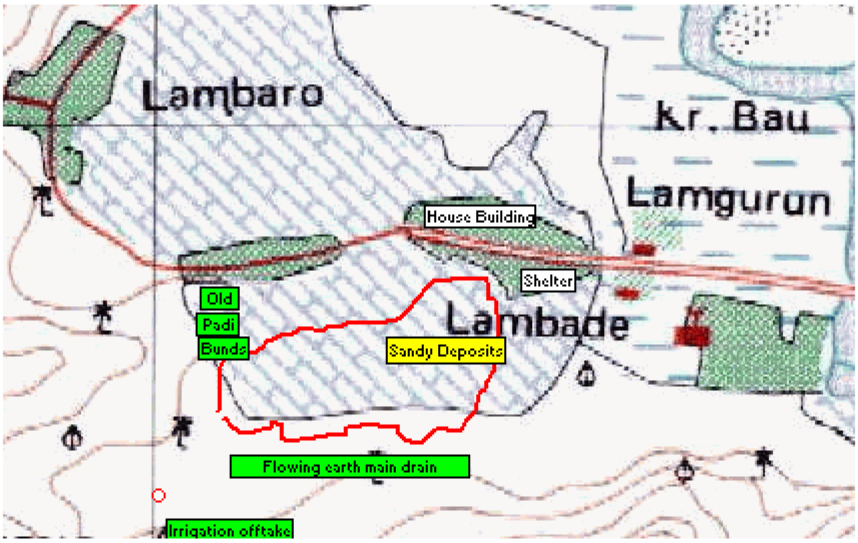
In Figure 1.2 various features have been noted:

- The irrigation off-take
- The main drain running east-west to the south of the site
- Field or terrace bunds in the north-west corner indicating the previously irrigated area
- Sandy sediments covering the eastern end of the site

The area outlined in red is the GPS trace of the boundary and that area measures 19.7 hectares, this figure being determined via the OziExplorer software.

Desa Lambadeuk is not named on the map used as a base for this exercise

**Figure 1.2 Locational Details**




***Note 1:*** *It should be noted that the GPS outline of the area would appear to be about 100m further south than the area as mapped – this estimate is based on the location of the road and the point where the access track leaves that road. This small difference could be due to less than perfect geo-registration of the map or slightly inaccurate GPS readings due to poor signal. This difference is of no importance or significance.*

***Note 2:*** *The alignment of the river which supplies the irrigation water has not been shown on the topographic map and a GPS trace of the river was not attempted. However, the approximate alignment is obvious to some degree to anyone accustomed to using maps, such as drainage and irrigation planners.*

## 1.4 Previous Land Use

According to local information this location was used for agriculture before the tsunami. There was an estimated 20 hectares of cultivable land with half of that, 10 hectares, being irrigated and used for padi. The irrigation supply allowed only one crop per year since the system was based on run-of-the-river water collection and the river only ran with sufficient water during good rainy spells. The off-take for the irrigation supply is located a few hundred metres upstream of the site where a concrete dam plus off-take has been built and the water was transported in a small concrete channel about 120cm wide by 150cm deep.

There is a known wild pig and porcupine problem on the location and the area is fenced in efforts to keep these destructive animals off the site. There were several areas seen where pigs had been rooting and digging and causing damage.

# 2. TSUNAMI DAMAGE

## 2.1 Introduction

Along the coastal strip there was generally devastating damage done by the tsunami and very few remnants of the previous buildings remain, usually only twisted metal the foundations or heavier parts of buildings – such as steps and stairs constructed of concrete. The foundations to previous houses are in evidence on this site. However, the physical damage caused to infrastructure in general is not the subject of this report. The only physical damage that is assessed is the obvious damage to the irrigation and drainage system.

The main emphasis and purpose of this visit was on the damage to the land:

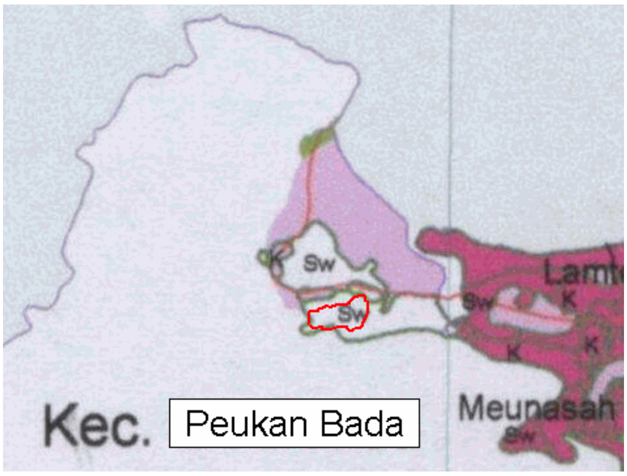
- Salinity damage, and
- Sedimentation plus the effects on the
- Irrigation and drainage infrastructure

More detailed information on the possible or expected effects of the tsunami are presented in the ETESP report "Soil Conditions for Wetland Rice".

## 2.2 Damage to the Land

Damage to the land was not quite as devastating as might have been expected at a location as close to the sea as this site is located. Local information is that there was a flood of about 2 - 3 metre in depth and that this flood did not remain on the land for long.

**Figure 2.1 ISRI Soil and Land Damage Map**




The recently published maps from a survey carried out by ISRI (Indonesian Soil research Institute, Bogor) indicate that the immediate area around the sites was not damaged at all. An extract of the IRSI map is presented as Figure 2.1 with the GPS outline of the site superimposed.

In the ISRI map the legend indicates:

- Light mauve – heavy damage due to salinity
- Dark purples – heavy damage caused by sediments and salinity

*NB ETESP has established that unless the sediments were sandy then depth of sediment cannot be considered as heavy damage, Refer ETESP Executive Summary, December 2006 and Tour report, February 2006.*

As can be seen in the figure above the site falls in the area which carries no colour and this indicates no damage at all or, so lightly damaged that it is considered negligible. ETESP does not totally agree with this classification (Refer Section 2.2.2).

### 2.2.1 Salinity Damage

With the very short duration of the flood (Section 2.2) the soils on this site were not expected to show many signs of salinity damage. Field salinity determinations of EC (Electrical Conductivity) could not be carried out as no salinity meter could be obtained for use.

There was relatively good vegetative cover over most of the site, apart from some of the sand covered areas, and the vegetation was of mixed species. In other recently visited areas the vegetative cover has been a reliable indicator as to whether there is a salinity problem or not.

It is concluded that there is not a salinity problem on this site and that the lack of vegetation on the sandy areas would be due to poor moisture availability for plant growth since sands have low available moisture holding capacity (AWHC).

**Figure 2.2 View Across the Site Showing Vegetative Cover**

Figure 2.3 Grey Coloured Sandy Deposits on Reddish Soil

### 2.2.2 Sedimentation Damage

Reference to Figure 1.2 shows that a large portion of the eastern part of the site has a covering of sandy deposits or sediments.

ETESP studies to date have shown that depth of sediment, in itself, is not as damaging as first thought. In fact, in some areas farmers and Dinas Pertanian staff have reported that many farms have been improved by the deposition of sediments. This "improvement" has resulted in areas of previously shallow soils being covered over by topsoil material relocated by the tsunami wave – the resulting, deeper soil then has more depth (root-zone) for plants to exploit in their search for nutrients and moisture. Depths of sand >20cm are considered to be a problem (ETESP Sandy Deposits, March 2006) since the sands have low AWHC, low fertility and the additional depth can result in the land being "out-of-command' for irrigation.

There are sandy deposits on this site and these deposits have to be investigated further and their depths, extent plus spatial distribution mapped out.

### 2.2.3 Damage to Irrigation Infrastructure

The irrigation infrastructure referred to comprises:

- The actual river off-take with settling pond and sluice
- The irrigation canal or channel transporting the water to the site
- The in-field distribution channels to get the water onto the fields, and
- The drainage system

The Off-take

Prior to this visit the Red Cross had cleared the off-take of debris and had repaired the sluice gate. However, subsequent rainstorms have caused the river to carry high volumes of water with the result that much more debris has now collected in the settling pond and partially covers the off-take.

The concrete wall of the actual dam is also badly damaged meaning that the water level in the pond will possibly not be high enough to ensure a reliable water supply enters the irrigation canal. This wall has to be repaired and even made higher if necessary.

Figure 2.4 Debris in the Off-take

Irrigation Canal or Channel

The original canal is concrete and inspection at present is not easy as much of the length of the canal is very heavily over-grown by wild vegetation. However, parts that could be seen indicated that generally the condition was not too bad.

At one or two points where the canal was actually covered the concrete covering was broken and debris had entered the canal blocking or partially blocking it. The whole length of the canal will have to be inspected for damaged areas and the requisite repairs carried out to ensure water flow is as good as the system will allow.

In-field Distribution Channels

In fact no existing in-field system could be located during the visit. This suggests that either:

- if the system was operational before the tsunami the channels were washed out by the flood or buried by the sediments, or
- perhaps the whole system had fallen into disrepair and was no longer in use before the tsunami

Figure 2.5 Old Earth Main Drain

Whatever the situation was before the tsunami a totally new, in-field distribution system will have to be designed and installed, possibly by the farmers them selves, before irrigated agriculture can proceed.

The Drainage System:
The requirements for, existence of and noted damages to the drainage system are noted in Table 2.1

**Table 2.1 Drainage System**

| Drain Type | Findings | Damages |
|---|---|---|
| • In-field drains | There was no obvious existing in-field drainage system seen though at one point on the lower edge of the site what could have been the remnants of a drain was identified. | If there were in-field drains then they were destroyed or buried by the tsunami |
| • Collector drain | This site originally had a good collector drain running along the lower edge as it was seen and noted – WP (waypoint number) 112. At this point the drain was not flowing but contained stagnant water, some 50 metres further along the drain had collapsed and was blocked. | There was no obvious damage to the collector from the tsunami though the blockage noted might have been due to the wave action |
| • Main drain (earth) | Just outside the fence along the lower, southern edge, there was a large, 2 metre deep drain which was functioning. This drain appeared to discharge into the main drain or river, but this is assumed as the drain was not followed to where it joined the main drain. | The earth main drain did not show any obvious, major impact effects from the tsunami. But the full length of this drain was not inspected |
| • Main drain (concrete) | There was a substantial concrete drain running north-south on the eastern edge of the area from WP 118 on the road. This drain was deeper at the southern end than the northern (ocean) end, depth ranged from about 75cm to over 150cm. The depth was limited near the northern end with some debris and a lot of sediment. | The concrete was broken and damaged in several places along the upper reaches of this drain. In some places the concrete had been “under-cut” – that is the soil material below the concrete had been eroded out. The sediment has reduced the operational depth of this drain |

This “main” drain must drain in two directions since, as pointed out earlier, the land on this site slopes away from the sea – that is it slopes inland. At some point there must be a high point, or watershed, in the drain where there is drainage flowing in two directions; inland and towards the sea.

**Figure 2.6 Up-slope in Main Drain towards the Sea**

**Figure 2.7 Main Drain Continuing to the Sea North of the Road**

## 2.3 Why Soil Damage was Relatively Light

From a soils perspective the damage at this location was relatively light in that the only damage that could be seen via casual inspection was the deposition of sand on the surface at the eastern end of the site. There will have been some salinisation but to a degree that has apparently not caused any great problem, or is it expected to cause a problem in the future. The area had two factors in its favour:

- Location and
- Existence of soil drains

### 2.3.1 Location

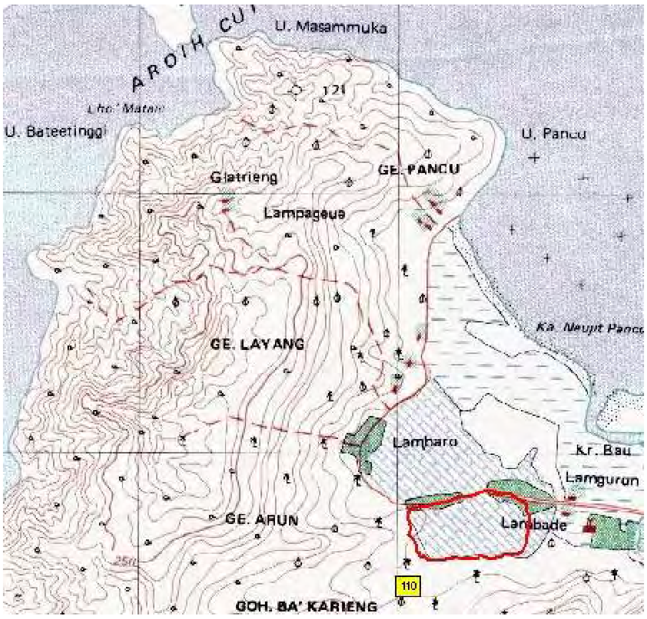
The main tsunami wave approached Sumatra from the west and in Figure 2.8 it can be seen that the Red Cross location plus the surrounding area was shielded from the full force of the wave by the hilly headland.

Once the wave reached the eastern shore of the headland its direction of approach would have been altered to quite an extent and perhaps it made landfall almost parallel to the coast. This would explain why the immediate shoreline was wrecked but lighter damage was suffered less than a few hundred meters inland.

### 2.3.2 Main Drains

Once the flood entered this area there was an easy route for it to leave since there were large drains, one of which led directly out towards the sea. In most other coastal areas soil damage was much more serious because the sea-water flood became trapped in cultivated areas and low spots because there was no easy way out.

**Figure 2.8 Site Protected by Headland**



# 3. RECOMMENDATIONS

## 3.1 Introductory Summary

The situation as of mid-March 2006 is summarised in Table 3.1 below with detail presented later.

**Table 3.1 Summary for the Site**

| No | Item | Findings | Problems and Amelioration Requirements |
|---|---|---|---|
| 1 | Salinity damage | No obvious signs of salinity damage | As and when a salinity meter is available, or when any soil sampling is done, the salinity (EC in dS/m) of the soil should be measured to confirm there is no problem |
| 2 | Sediment damage | There are sandy deposits over much of the site, most obviously on the lower areas at the eastern end of the site | The first and most important requirement is to carry out a rapid survey to establish the depths and distribution of the sandy deposits<br><br>Thin (5 – 15cm) layers of sand are no problem and should just be ploughed in and mixed with the original soil<br><br>Sands deeper than 15 or 20cm depth are a problem since:<br>• sands offer very low moisture reserves for plant growth and survival (low AWHC)<br>• sand offer very low reserves of nutrients for plant growth<br>• sands have very high infiltration rates and any irrigation water would pass to depth very rapidly, this is no good for wetland rice<br>• in some areas the additional depth of sediment on top of the original soil could mean that the irrigation supply is no longer able to supply irrigation water to the land – the land could be too high and "out-of-command" |
| 3 | Irrigation system | The system is in need of total refurbishment starting with the settlement pond, then the irrigation supply canal right down to the in-field water distribution channels | • Clear all debris from the intake and monitor the intake for accumulation of additional debris in the future – clear on a regular basis<br>• Repair the main dam wall of the settlement tank, ensuring that the water level will be high enough to enter the irrigation canal via the off-take<br>• Clear and repair the entire length of the irrigation supply canal<br>• Ensure that the irrigation canal is able to command the land that can be irrigated – that is either raise the canal or lower the level of the land to be irrigated<br>• Re-establish terraces or bunded fields with accompanying water supply channels to distribute the water |
| 4 | Drainage system | There is a drainage system but some parts require immediate rehabilitation, some current "improvements" must be stopped and in-field drains should be considered | • Repair all tsunami damage to the structures of the main (concrete) drain<br>• Check, clear and rehabilitate the full length of the (earth) collector drains. No drains, apart from the damage concrete main drain, should be constructed or lined with concrete<br>• Construct in-field drains to ensure any salts that are present are leached to depth and removed from the location. This will ensure any existing salinity is removed and that in future salinity will or should not build-up<br>• All drains should be protected by earth bunds to prevent irrigation or rainfall water flowing straight off the land into the drains |
| 5 | Rain fed areas | Create field bunds around all plots or fields | • Since irrigation supply is limited in the area all efforts must be made to retain any water that enters the fields via precipitation. All fields and plots must have earth bunds constructed along the edges to ensure any water landing on the soil infiltrates or enters the soil and cannot run-off and be lost to drainage<br>• Some simple water-harvesting techniques could be considered where soil conditions allow<br>• Thin coverings of sand or sandy soils can actually be of benefit in rain-fed areas since any rainfall (precipitation) landing on the sand will infiltrate rapidly and add to the reserves of moisture in the soil |

## 3.2 Salinity

As stated in previous sections of the report no obvious salinity problems appear to exist. However, as a precaution, it would be advisable as and when a survey is undertaken to establish the depths and distribution of the sandy sediments, to collect soil samples from pre-determined parts of the location. The sampling should be designed to ensure overall coverage – and have those samples analysed as indicated in section 3.7 below.

## 3.3 Sediments

The only sediment damage noted within the location was the presence of sands on the surface over quite a large area, especially at the eastern end of the site.

Before other interventions are installed it would be very advisable to have a rapid survey carried out by a soil surveyor to map the distribution and depths of these sandy deposits. This does not need to be a formal soil survey with full profile descriptions but the aim could be accomplished by an auger survey making note of depths of natural horizons or layers defined by soil colour and / or soil texture. Suggested numbers of points to be described are detailed in Table 3.2 below, this table is one of the ETESP tools and the calculations are based on size of area and density of sites required to achieve various reliability levels of mapping.

**Table 3.2 Suggested Number of Survey Points**

| Survey Level Routine Soil Survey | Map Scale | Area of 1cmx1cm of map | Target observation density (FAO Min) | Target observation density (FAO Low) | Target observation density (FAO Mid) | Target observation density (FAO High) | Survey Area Extent | Number of Sites for the survey | Number of Sites for the survey | Number of Sites for the survey | Number of Sites for the survey |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1: | Ha | Sites / Ha | Sites / Ha | Sites / Ha | Sites / Ha | Ha | FAO Min | FAO Low | FAO Mid | FAO High |
| Extremely detailed | 1000 | 0.0100 | 10 | 25 | 50 | 100 | 20 | 197 | 493 | 985 | 1970 |
| Extremely detailed | 1500 | 0.0225 | 4 | 11 | 22 | 44 | 20 | 88 | 219 | 438 | 876 |
| Extremely detailed | 2000 | 0.0400 | 3 | 6 | 13 | 25 | 20 | 49 | 123 | 246 | 493 |
| Very detailed | 2500 | 0.0625 | 2 | 4 | 8 | 16 | 20 | 32 | 79 | 158 | 315 |
| Very detailed | 5000 | 0.2500 | 0.40 | 1 | 2 | 4 | 20 | 8 | 20 | 39 | 79 |
| Detailed | 7500 | 0.5625 | 0.20 | 0.5 | 1 | 2 | 20 | 4 | 10 | 20 | 39 |
| Detailed | 10000 | 1.000 | 0.10 | 0.25 | 0.5 | 1.0 | 20 | 2 | 5 | 10 | 20 |

*Based on: FAO Soil Bulletin No 42, Soil Survey Investigations for Irrigation, 1986*

ETESP would suggest aiming to map at 1:2500 or 1:2000 scale and employing the FAO "Mid Category" of reliability. This would require between 150 and 250 rapid soil observations but a skilled, experienced soil surveyor could reduce this number considerably by using a phased approach. That is, at first do a reduced density, say 50 observations, to check if these observations would allow boundaries to be drawn. Any boundaries drawn would then be checked by doing intermediately located spot observations. This process would be continued until a reliable map could be produced. Inexperienced field surveyors would be advised to initially do a higher level of observations than indicated for an experienced operator.

## 3.4 Irrigation

It is suspected that perhaps the irrigation system was not fully operational before the tsunami struck and it is not easy to determine if the damage to the off-take settlement pond was tsunami inflicted or not – whatever the cause some major engineering inputs might well be required to get this system operational again. At present the bed of the river channel is a long way below the off-take sluice gate and some engineering advice might be required as to how best ensure the system could trap sufficient depth of water to enable it to enter the irrigation canal. In addition, the wall of the dam has been breached and the whole structure may well have been weakened. Advising on the required interventions is beyond the capabilities of the Soil Specialist but the Irrigation & Drainage Component of ETESP might be able to offer some technical advice.

## 3.5 Drainage

To operate efficiently with reasonable guarantees of salinity not building-up in an irrigation system the following system of drains is normally required:

- In-field drains
- Collector drains, and
- Main drains

On this location the collectors and main drain already exist and some indications of what must be done to improve or re-furbish them are given in Table 3.1 and below. However, there are no obvious signs of in-field drains and these should be constructed to obtain maximum efficiency of the installation.

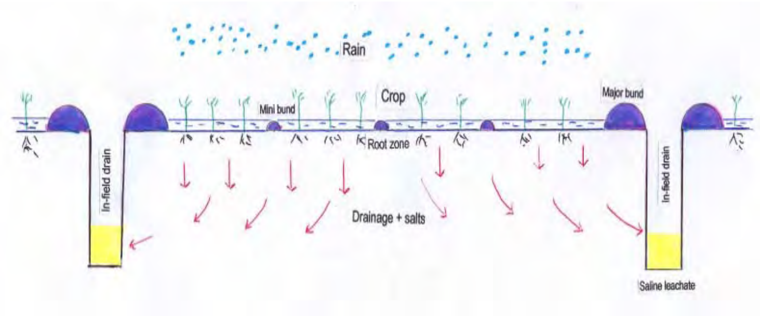
In-field Drains

In-field drains are drains that are dug at intervals in a network that covers all of the irrigated or cultivated area. More detail on the subject can be found in ETESP “Scenarios” – Scenario No 6, Update of March 2006.

These drains are excavated to approximately 100cm depth in the soil and they must NOT be lined in any way. Grass may well grow on the edges and sides of the drains and this would help stabilize them but vegetation has to be kept under control or it can block the flow in the drains.

There was no obvious existing in-field drainage system seen though at one point on the lower edge of the site a remnant drain was identified.

**Figure 2.5 In-field Drains Cross Section**




In-field drains have to have bunds installed along their length to prevent surface water (rainfall or irrigation) from flowing directly into the drain instead of infiltrating into the soil.

Collector Drain

The in-field drains discharge into larger, slightly deeper drains called collector drains which, like the in-field drains, are constructed by digging channels usually along the down-slope edge of the irrigated or cultivated site and, again, these drains are not lined in any way (for example with concrete). The collector drain will, like the in-field drain, also allow ground water to enter it directly from the sub-soil.

This site originally had a good collector drain running along the lower edge as it was seen and noted – WP (waypoint number) 112. At this point the drain was not flowing but contained stagnant water, some 50 metres further along the drain had collapsed and was blocked.

From near the water tank (WP 111) this drain had been refurbished but it had been rebuilt with concrete, in fact at first the Soil Specialist assumed this was an irrigation channel. As it is installed at present this drain will act as a surface-water drain only and will actually reduce the amount of water that will infiltrate into the soil – plus it will not be able to remove any excess water from the sub-soil.

No more concreting should be done but what has been constructed should remain in place but field edge bunds must be constructed (Figure 2.5) to ensure that any water that does enter the field is allowed to infiltrate and not immediately drain away by flowing directly into the drain.

**Figure 2.6 New Drain**

Main Drain

This subject has been discussed sufficiently above and further comment is beyond the capabilities of the Soil Specialist. A competent drainage engineer should be consulted and perhaps the Irrigation and Drainage Component of ETESP could offer some advice.

## 3.6 Rain-fed Areas

Pre-tsunami it is reported that there were about 20 hectares of land under cultivation at this location with half of this being irrigated and half being rain-fed.

Since there has been sand sediment added to the soils the overall soil texture will have been diluted to some extent – that is soils will, overall, be sandier than they were (for example, clay loams may now be sandy clay loams or sandy clay loams now sandy loams). Sandier soils have poorer AWHC and nutrient reserves than finer textured soils so care will have to be taken that crops to be planted are suited to the soils as they now exist and will grow on these soils.

Similarly, the fertility status and fertility potential should be considered and further agronomic and soils technical inputs might be in order once the full details of the soils in the area have been determined and suitable inputs of organic manures and mineral fertiliser applied.

To help boost moisture reserves in the rain-fed areas bunds should be constructed around plots or fields to ensure that any precipitation that does land on the fields remains there and does not run-off and be lost in the drainage. Similarly, if there are some non-sandy surface soils that are out of command for irrigation the moisture reserves could be improved by installation of simple water-harvesting interventions.

## 3.7 Final Interventions

Once the items detailed in sections 3.2 – 3.5 have been addressed and interventions applied the site would be almost ready for normal agricultural activity.

The recommended final interventions comprise:

1. Shallow depths of sand and other sediments should be thoroughly mixed in with the original, underlying native soil by ploughing. The first ploughing might be easier to achieve with the soil dry – that is not flooded as for puddling and padi preparation.

2. If available, large amounts of organic composts and manures should then be incorporated into the soil / sediment mixture by further ploughing. Mineral fertilisers can also me added at this time if planting is planned in the immediate future

3. If the soil is to be used for padi then it should be puddled following the normal procedures used by the farmer. One point to bear in mind is that when the soil texture has been diluted by ploughing-in sand the sand will settle out first when the soil is puddled – this means that the resultant top layer of soil may have a texture very similar to the original soil of the site

4. A first crop should then be planted and progress monitored carefully to enable good feedback to the extension service (ETESP has compiled a very simple format for monitoring in a way that gives feedback when the collected data are added to the monitoring form on computer)

The only other intervention that ETESP would suggest at this time should be considered after the first harvest is gathered and an estimate of the quality and quantity of the harvest made – how close to the expected, pre-tsunami norm? If the yield is depressed to any great extent then soil sampling should be considered and the samples subjected to normal laboratory analyses for:

- Soil Reaction with pH (water) and Exchangeable H (hydrogen) and Al (aluminium)
- Soil EC – in dS/m
- Exchangeable-Ca (calcium)
- Exchangeable-Mg (magnesium)
- Exchangeable-K (potassium)
- Exchangeable-(sodium)
- Total-N
- Organic carbon
- Available-P, and
- CEC – Cation Exchange Capacity

These routine soil analyses could be carried out by ISRI, Bogor. Once obtained the data should be entered into the ETESP tool (Excel spreadsheet) "ETESP Lab Data Summary Ver 4". This tool applies ratings to the level of the various nutrients and also presents a summary indicating fertility level, any possible deficiencies and obvious risk factors presented by the chemical status of the soil.

# 5. ETESP Soil Desalinisation and Improvement Reports and Tools

## 5.1 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

ETESP, Bireuen Kabupaten, *Samalanga, Jeunieb, Jeumpa, Jangka and Ganda Pura*, Data Assessment and Soil Reclamation, DECEMBER 2005

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

## 5.2 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

ETESP, Sandy Sediments, FEBRUARY 2006

ETESP, Soil Conditions for Wetland Rice, MARCH 2006

## 5.3 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 20$^{th}$ – 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

## 5.4 ETESP Soil Desalinisation and Improvement Tools

| File name and date | Purpose |
|---|---|
| ETESP<br>ECe from EM38 data.XLS<br>OCTOBER 2005 | Calculate soil salinity (ECe) values from raw data collected by EM38 salinity device when no calibration information provided |
| ETESP<br>Leaching Water Requirements.XLS<br>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:<br>• Textural class of soil<br>• Initial salinity of the soil (dS/m)<br>• Target salinity wished to be achieved (dS/m) |

| | |
|---|---|
| ETESP<br>Irrigation Leaching Progress.XLS<br>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:<br>• Soil textural group, or<br>• AWHC (Available Water Holding Capacity)<br>• Estimate of water application efficiency, or use default values<br>• Size of irrigation gift as mm of water<br>• |
| ETESP<br>Survey Density.XLS<br>DECEMBER 2005 | 1. Correlate the scale at which to map surveys of various types from reconnaissance to very detailed level<br>2. Determine observation density (Sites / hectare)<br>3. Calculate the total number of sites for surveys at various reliability levels<br><br>Requirements:<br>• Survey area extent in hectares (ha)<br><br>Also presents various map and mapping information |
| ETESP<br>Labdata summary.XLS<br>Version 4<br>FEBRUARY 2006 | Enter standard laboratory data and obtain ratings as to the level of all the various nutrients and chemical properties.<br><br>Also calculate weighted mean vales for topsoil and subsoil plus obtain automatic simple summary of:<br><br>• Inherent fertility<br>• Fertility potential<br>• Possible nutrient deficiencies<br>• Salinity status, and<br>• Reaction<br><br>Also experimental estimate of possible perceived risks |
| ETESP<br>Site Monitoring tool.XLS<br>March 2006 | Enter field data for specific sites or villages making note of :<br><br>1. <u>Locational information</u><br>• Kabupaten<br>• Kecamatan<br>• Desa<br>• Farmer or Land-owner, and<br>• Geographic coordinates<br><br>2. <u>Soil, land and crop features</u><br><br>• surface soil textural group<br>• soil salinity<br>• soil acidity<br>• irrigation water quality (salinity)<br>• status of drains, plus<br>• estimate (%) of the actual pre-tsunami crop yield<br><br>to monitor land reclamation progress and get information on further interventions possibly required |

| | |
|---|---|
| ETESP<br>Soil Conditions Database tool.XLS<br>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:<br><br>• surface soil textural group<br>• soil salinity<br>• soil acidity<br>• irrigation water quality (salinity)<br>• status of drains, plus<br>• estimate (%) of the actual pre-tsunami crop yield<br><br>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 |