

EARTHQUAKE and TSUNAMI EMERGENCY SUPPORT PROJECT (ETESP)

OXFAM SITES SOUTH OF CALANG



(March 2006)

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VISIT TO OXFAM SITES SOUTH OF CALANG

1. Purpose of Visit

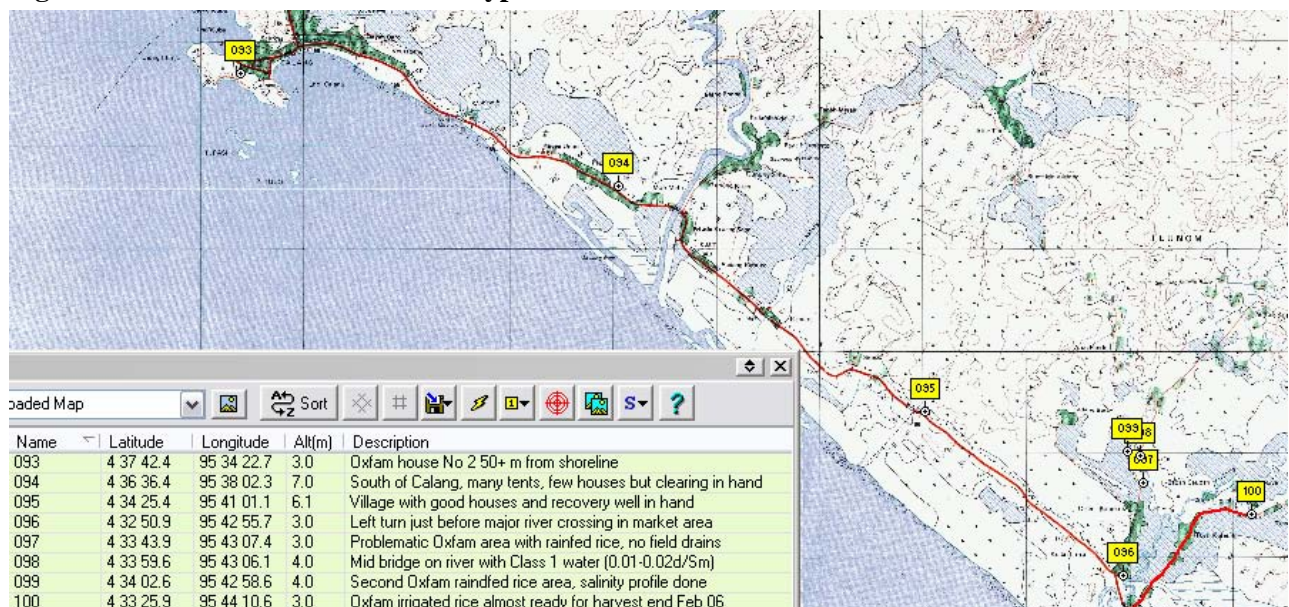
In November 2005 FAO Banda Aceh suggested to the Oxfam Team Leader that the ETESP Soil Desalinisation and Improvement Specialist might be able to advise and assist them on soil and land-use problems they, Oxfam, were experiencing on some of their sites in Calang. Accordingly, the soils specialist contacted Oxfam and arranged to carry out a technical inspection of the sites as soon as was feasibly possible. Arrangements could not be completed in time to allow the visit in December 2005 hence the visit took place in late February 2006.

This "site visit" report has been compiled from a technical point of view and the Soils Specialist has not considered any implications of or on the strategies, plans or intentions of the NGO, the ETESP (Earthquake and Tsunami Emergency Support Project) or Dinas Pertanian.

2. Location

Oxfam operate out of Calang in Aceh Jaya Kabupaten and the sites in question are in Kecamatan Panga. In Figure 2.1 the yellow boxes are the numbers of Waypoints (WPs) collected by GPS during the trip. Details of what was noted at each waypoint can also be seen in Figure 2.1 but these details - apart from the sites at WPs 97, 99 and 100 - are not discussed in this report but are presented as a matter of course since the data were collected.

Figure 2.1 Locational Details with Waypoint Data



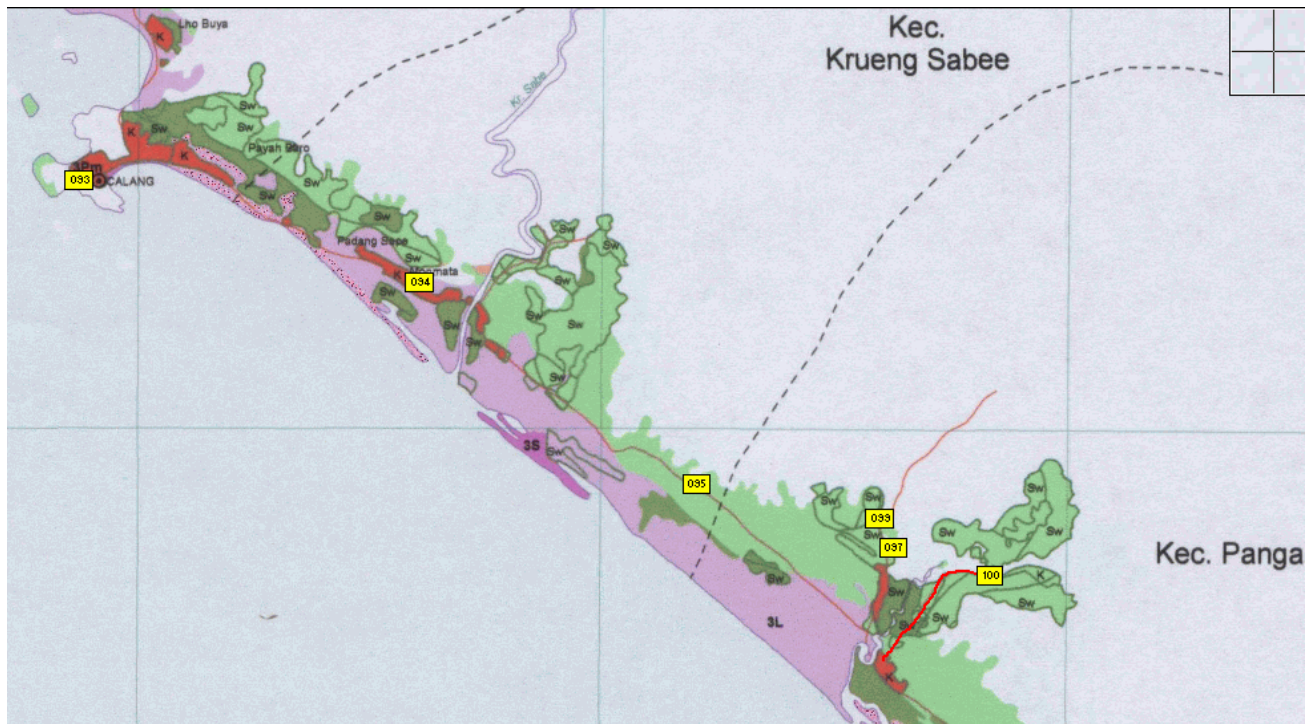
The sites are all located approximately 30 minutes south of Calang on the northern side of the main road at a distance of 3 - 4 kilometres from the coast at an altitude (GPS derived) of between 3 and 4 metres above sea level.

3. Tsunami Damage

Along the coastal strip there was devastating damage done by the tsunami and there are very few remnants of the previous buildings etc, but there is a large collection of artifacts including twisted metal that used to be bridges, road decks washed well inland and only the foundations or heavier parts of buildings – such as steps and stairs constructed of concrete.

However, slightly further inland – such as at the sites in question – damage to the land was not quite as devastating. At the sites in question there was a flood of about 1 metre in depth and 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 only slightly damaged. An extract of the IRSI map is presented as Figure 3.1 with the GPS waypoints superimposed.

The damage has been recorded as slight and this was mainly from the salinisation of the soil from the sea water. However, as the areas in question (WPs 97, 99 and 100) were all previously used for rice cultivation the flood water became trapped in the fields – this is because rice fields are designed with bunds to retain the water that is added or applied to the site, whether that water is added by irrigation, rainfall or, as in this case, by flood. Being trapped on the sites the sea-water would then have infiltrated the soil and caused salinisation. This has now been recognized as one of the ETESP Scenarios; refer ETESP 2006 update of Scenarios.

Figure 3.1 ISRI Soil and Land Damage Map with Waypoints of Sites

In the above ISRI map the legend indicates:

- Orange – heavily damaged settlements
- Purples – heavy damage caused by sediments and salinity
- Dark Green – medium damage, mainly from salinity and sediments
- Light Greens – light damage from 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 sites fall in the lightly damaged area and ETESP would agree with this classification.

4. Present Situation

4.1 Introductory Summary

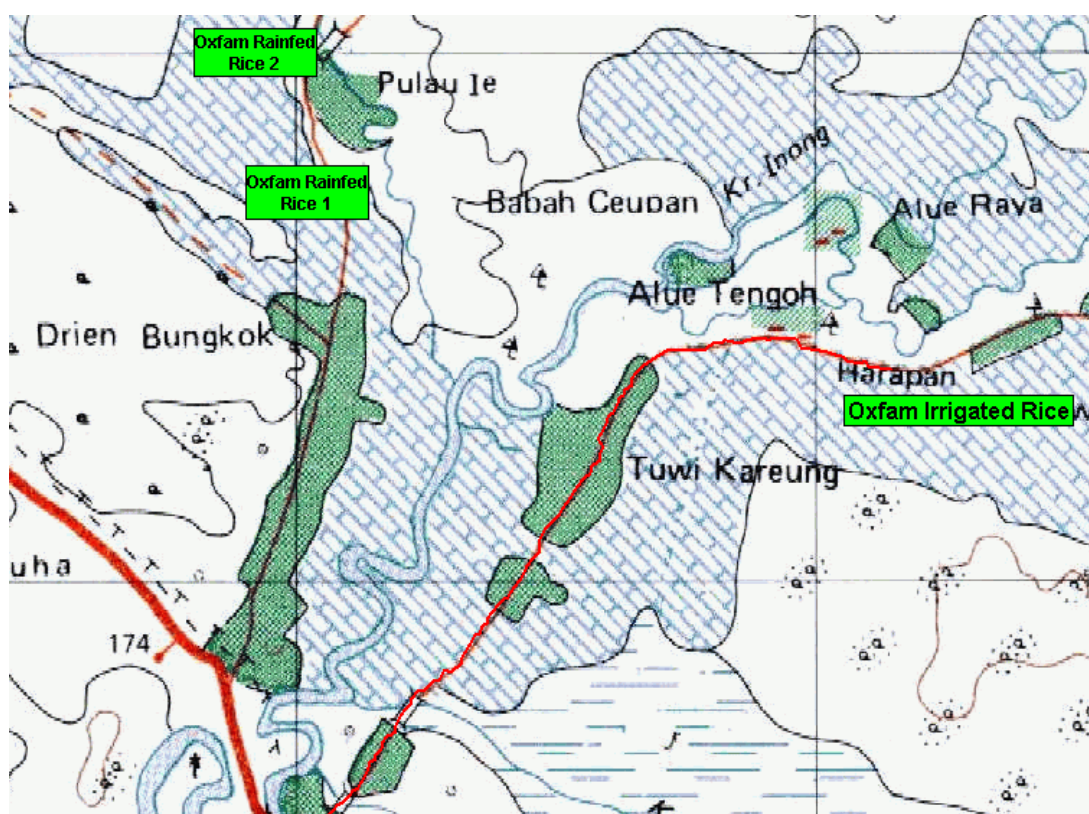
The situation as of late February 2006 is summarised in Table 4.1 below with detail presented later.

Table 4.1 Summary Data for the Sites

Site / WP No	ETESP Legend *	Present Land Use and status	Findings	Requirements
97	Oxfam rain fed rice 1 4km from coast	Rice at the vegetative state with surface flooding	Rain fed rice in the early or vegetative stage is growing quite vigorously but rice in such fields has often totally failed to develop any grain	This land requires field drains and, if irrigation were contemplated, land leveling to help achieve full recovery
99	Oxfam rain fed rice 2 4.5km from coast	Rice at the vegetative state with surface flooding	As above but with some minor channels (possibly erosional in origin) which are draining some sections	This land requires field drains and, if irrigation were contemplated, land leveling to help achieve full recovery
100	Oxfam irrigated rice 4km from coast	Irrigated rice with grain and almost ready to be harvested	This land would appear to have been reclaimed and is back in production but, no prediction of expected yield is made here.	This land appears to have recovered but some fertiliser inputs may be indicated once the yield obtained is measured

Note * refers to Figure 4.1 below.

Figure 4.1 Extract of 1:50,000 Scale Topographic Map with Oxfam Sites



4.2 Site Information, Description and Requirements

Each site is described in general layman terms and the various features noted at each site are presented along with the suggested remedial interventions, if any.

4.2.1 Rain-fed Rice Site 1 – WP 97

This site is about 4km inland from the coast and at about 3 masl (metres above sea level) altitude, however altitudes are GPS derived and may not be too accurate. The crop, now in the early or vegetative stages of growth, is the first post-tsunami crop on this land and is basically a test planting to see if it is successful – if the land is still saline then this crop will fail or give a very poor yield. Such a failure would be expected by ETESP.

The site is very uneven with fields or plots at various levels and the site could not be used for irrigated agriculture even if a water supply existed. However, within plots the leveling is acceptable and generally the height of the crop within plots was relatively uniform. On the down-slope side of the site a drain has been opened and that drain is flowing so some drainage is occurring.

The surface was very wet and the site was more in an uncontrolled flooded state than in an irrigated state and it was almost impossible to walk across the site without sinking deeply into the soil. Even the between-plot areas, they hardly qualified as bunds, were very wet. Surface water salinity was measured and reading fell between 0.70 and 1.02 dS/m and would be classified as medium to high salinity water. The classes are defined in Table 4.2 below which is extracted from ETESP, Mobilisation Report, 2005.

However, this is not irrigation water and is more likely to have accumulated as the result of rainfall or as a result of continued flooding. Surface water accumulating from rainfall should, in theory, have very low or no salinity at all. The water reaction was also measured and it proved to be neutral with a pH of 7.

In ETESP opinion this crop will fail as every indication is that this site is still saline – this is concluded from the salinity found in the surface water. The remedial action or intervention required is the installation of field drains running across the site and discharging into the existing drain noted above. Refer Section 5.

4.2.2 Rain-fed Rice Site 2 – WP 99

This site is about 4.5km inland from the coast and at an altitude of about 4masl. Like the site described above it carries a crop of rain-fed rice and, from all appearances, the situation is very similar to the situation at WP97. However, this site may well have supplied the answer to the problem.

There is a well established drain running on the northern edge of this site and that drain, which was flowing quite strongly, leads and discharges into the local river. In addition, a small side channel was located within the rice and this side channel was discharging into the above drain. Refer Figure 4.2. This side channel may be erosional in origin but it is acting as a drain for a small section of the rice field.

Figure 4.2 Side Channel Discharging into Drain



To check and confirm the ETESP hypothesis that the problem is salinity and that this channel is acting as a drain several water salinity measurements were made using a portable salinity meter. Readings were taken every metre or so from the within the cropped area along this channel and it was found that the salinity of the water flowing in that channel was increasing as it progressed – indicating that it was gathering saline leachate from the field.

At the furthest point from the drain (furthest into the crop) there was an EC reading of just under 1.4dS/m, at the next point the reading was 1.47dS/m and near the end of the channel just before it discharged into the drain the reading had increased to 1.59dS/m – these are all high salinity class readings (Table 4.2). All these samples had a pH of 7, which is neutral.

Water salinity (EC) readings were also taken in the drain, upstream and downstream of where the side channel discharged:

- Upstream water salinity 0.06dS/m [low salinity water]
- Downstream water salinity 0.14 – 0.19dS/m [low salinity water, but significantly more saline than the upstream sample]
- Discharge area water salinity – very varied indicating that mixing was happening

If there were more side channels discharging into this drain then the salinity level would increase but, at present, very little saline leachate is entering the drain. In fact, this water could at present be used for applying to the fields of this site to help leach the salts out – the problem would be how to get the water raised from the ditch onto the field. Also, the

salinity of the water would have to be constantly monitored and the activity stopped if salinity increased to any great extent (a cut off when water salinity exceeded 0.5dS/m would be suggested)

Water salinity was then also checked in the local river, into which the drain discharged; the river water returned a reading of 0.0dS/m, that is totally non-saline water.

This site is saline, there is a crop at the vegetative stage of growth and the prediction is that this crop will fail or return very low yield. As with the site at WP 97 the necessary intervention is the installation of field drains of about 100cm depth, discharging in to the existing drain. Refer Section 5.

4.2.3 Irrigated Rice – WP100

This site, which suffered a one metre inundation by the tsunami, is located about 4km inland from the coast and at an altitude of about 3masl and is presently carrying an irrigated crop of rice which will be harvested soon. Casual inspection of the site showed an even stand of rice and grain had formed – suggesting that the site is no longer saline, or saline enough to cause major problems.

The irrigation supply appeared plentiful and ran parallel to the asphalt road running along the upper edge of this site and there was a drain on the lower edge of the site plus field-drains were reportedly installed at right angles from the drain. The irrigation water supply EC (Electrical Conductivity) was measured as was the pH – salinity was nil (0.0dS/m or Class 1 Low salinity water) and water pH was 7 or neutral.

The only interventions that might be considered for this site should be considered after the 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.

Table 4.2 Irrigation Water Classification

Irrigation water Salinity Hazard Class	ECw (dS/m)	Description & Notes
C1 Low salinity water	<0.25	Can be used for most crops on most soils with low chance of developing a salinity problem. Some leaching required but this would happen under normal, well managed irrigated agriculture
C2 Medium salinity class	0.25 – 0.75	Can be used if a moderate amount of leaching occurs. Crops with moderate tolerance to salinity can be cultivated without special measures for control of salinity
C3 High salinity class	0.75 – 2.25	Cannot be used on soils with restricted drainage. Even with adequate drainage special management for salinity control will be required and crops with high tolerance to salinity used.
C4 Very high salinity class	>2.25	Not suitable for irrigated agriculture under normal circumstances. Soils must be very permeable (sandy), drainage must be good, irrigation water must be supplied in excess to provide excessive leaching and only very salt tolerant crops can be grown

5. Recommendations and Interventions

5.1 Irrigated Site

The irrigated site (WP100) would appear to have recovered, at least to the point where a crop is going to produce a yield though that yield may still be below what was achieved pre-tsunami. The only recommendation for this site is to assess what level of yield is achieved and then decide if soil analyses should be done to establish if there are any nutrient deficiencies or imbalances.

5.2 Rain-fed Sites

The rain-fed sites (WPs 97 and 99) present the worst-case position under the ETESP Scenario 6. The main problems here are that:

- flooding still exists on the site and the flood water that was checked was very saline
- there is a lack of in-field drainage to help get the saline water from the field into the existing drain
- there will have to be reliance on rain-fall to supply the water required for leaching

5.3 Recommendations

- The first and immediate step must be the excavation of in-field drains to 75-100cm depth at, say, 50 metres spacing
- These in-field drains, dug into the soil and not lined in any way, should discharge into the existing collector drain that has been cleared / constructed at the edge of the block of fields
- Better bunds should be constructed round each field or plot to help ensure that any rain-fall that does occur stays on the field or plot and then infiltrates into the soil and does not run directly into the newly constructed in-field drains.
- The salinity of the leachate (water in the in-field drains) should be monitored regularly to check the salinity, as was done during the site visit with the salinity meter
- When it is considered that the salinity has lowered sufficiently a crop should be tried, possibly a salt tolerant species such as water-melon. This may not be what the farmer wants but some crop could be economically more rewarding than no crop
- Once crops can be grown the yields should be assessed and compared with pre-tsunami yields and consideration given to possibly taking soil samples and having those sample analysed in the laboratory – refer Section 4.2.3 above
- If any way can be devised to raise the water now flowing in the drainage ditch (pumps, water-screws or water-wheels – this should be some form of appropriate technology and not via the installation of expensive equipment) that water could be used for reclamation leaching by applying it to the surface of the freshly banded plots. Use of this water would have to be monitored and discontinued if the salinity rose above about 0.5dS/m

6. River Channels

6.1 The Situation

Another, related problem affecting this area and, in fact, most of the west coast is the state of the river channels. In many places the river channels are blocked or flow is badly restricted due to the amount of debris in the rivers. The debris comprises:

- trees and other plant material, part of the legacy of the tsunami
- non-vegetative material such as parts of bridges, houses and other structures
- silt, sand and other soil materials being trapped by the above debris

Figure 6.1 Clogged river



Figure 6.2 River Flooding



The effect of this debris is that the river flow is vastly reduced or stopped all together and often the river is considerably wider than it was and often flooding the land through which it flows. The knock-on effects are that the river is no longer able to transport water from upstream – and this water will contain the saline leachate from the sites that are being reclaimed – and remove the dissolved salts from the land by transporting them back to the sea.

If the rivers were flowing as they used to they would be greatly assisting the recovery of the land by removing any saline leachate that is discharged into them from drains, as it is the flooded areas will be slowly becoming more saline.

6.2 Amelioration Requirements

Although dealing with river channels is not part of the remit of the Soil Desalinisation and Improvement Specialist it is considered that factors such as this will need to be addressed at some time - and the sooner the better.

What has to be done would include:

- clearing any sand-bars at the mouth of the rivers where they discharge into the sea – this has been previously mentioned in ETESP reports. This would be a major task and would involve the use of dredgers which would gain access via the sea
- once the river mouths were cleared the same action would be required back-up the course of the river – that is the main river channel deepened by dredging
- at the same time all debris would need to be removed from the river-course to enable normal river flow to resume

All of these tasks would involve major civil works and use of specialized, heavy equipment and prove a very expensive operation.

6.3 Recommendations

Some competent body should consider compiling a proposal or concept note as to exactly what is required; each river will be different so a separate document would be required for each location. The proposal or concept note would then have to be brought to the attention of some funding agency in the hope that funds could be found or made available to, at least, carry out a feasibility study.

7. ETESP Soil Desalinisation and Improvement Reports

ETESP Agricultural Component, Desalinisation & Soil Improvement, Mobilisation Report, OCTOBER 2005, Updated FEBRUARY 2006

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

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, Background Paper, Soil Acidity and Aluminium, DECEMBER 2005

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

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

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

ETESP, Digital Maps, FEBRUARY 2006

ETESP, Interpretation of Laboratory Data for ETESP Irrigation Component, FEBRUARY 2006

ETESP, Earthquake & Tsunami Emergency Support Project, Sandy Sediments, FEBRUARY 2005

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